

# AutoDetect

Broadcast Automation  
Based on Detecting Cue Tones



*Revision as of December 21, 2007.*

User's Guide



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## Introduction

The AutoDetect software is a set of programs for detecting cue tones in the broadcast signal.

Using this software allows you to automate controlling the broadcast. For example, to organize automatically inserting blocks of commercials by the cue tones.

The AutoDetect software allows you to detect cue tones of two types: DTMF and jingles.

The AutoDetect software is an additional program option used along with the FDO nAir program (Forward TA/Forward TP/Forward TP2 software package).

The AutoDetect software includes:

- detecting modules performing the monitoring of the input audio signal for the purpose of detecting the specified cue tones;
- configuration programs:
  - SLDTMFConfig – for the DTMF tones;
  - SLJingleConfig – for audio files;
- an assistance program SLJingleTuning intended to test and select optimal parameters for detecting.

## General Information of Using the AutoDetect Software

### 1. Scheme of Using the AutoDetect Software When Working with Cue Tones

Programs included into AutoDetect are used to set up detecting cue tones and detect cue tones in the broadcast signal.

The Figure below shows the general scheme of using the AutoDetect software programs (in yellow) and Forward T software programs (in blue) when working with cue tones (preparing and controlling the broadcast).

The set of the used programs depends on the type of cue tones: jingles or DTMF.

Stage:	Preparing to Work				Controlling Broadcast	
Task:	Preparing Samples	Setting Detection Parameters	Testing Detection Parameters	Creating a Schedule	Monitoring, Detecting, Sending GPI Signals	Executing Commands
Jingles	FDCapture	SLJingleConfig	SLJingleTuning			
	Forward AV Studio			FDO nAir	Detecting Modules	FDO nAir
DTMF		SLDTMFConfig				

### 2. Automatically Controlling Broadcast via the AutoDetect Software

The following software is activated in controlling broadcast via the cue tones:

- detecting modules from the AutoDetect software;
- the broadcast automation program FDO nAir (see «FDO nAir: Broadcast Automation» User's Guide).

The programs interact as follows:

1. To detect a cue tone, the detecting module continuously monitors the input audio signal comparing it with the sample.
2. When the cue tone is detected, the detecting module generates a control signal.
3. In response to it, the corresponding command (e.g., to start a block of commercials) triggers in a certain interval (the specified delay time) in FDO nAir.

### 3. Program Interaction

The interaction between the detecting module and FDO nAir is realized via the GPI interface:

- the detecting module generates signals analogous to those started by pressing the GPI button;



- FDO nAir responds to the GPI signals performing the actions specified.

✓ **Important:** The executed schedule must have special commands so the FDO nAir program can respond to GPI signals. Each command of the type determines to which signal and which way to respond.

🌞 **Tip:** For a detailed description of commands that use GPI signals see the «FDO nAir Commands: Broadcast Automation» User's Guide.

#### 4. Preparation for Using Jingles

Preparation for the automatic control based on using jingles involves the following steps:

1. Preparing audio samples (via the FDCapture and Forward AV Studio programs) for detecting.
2. Configuring GPI events in the SLJingleConfig program.
3. Testing and optimizing the detection parameters in the SLJingleTuning program.
4. Inserting (into the FDO nAir schedule) commands that use GPI events for control.

#### 5. Preparation for Using DTMF Tones

Preparation for the automatic control based on using DTMF tones involves the following steps:

1. Configuring GPI events in the SLDTMFConfig program.
2. Inserting (into the FDO nAir schedule) commands that use GPI events for control.



## GPI Events

### 1. Function

When controlling by the cue tones, some special commands are used in FDO nAir. Each command of the type determines the action which is to be performed when detecting a certain audio signal at the audio input.

When using jingles, a collection of audio signals can be assigned to one command, that is the same action can be performed when any jingle from the specified set is detected.

Setting a correspondence between the jingles and control actions in FDO nAir is performed when configuring a GPI event.

### 2. Configuring

Setting GPI events is performed in the following programs:

- [SLJingleConfig](#) – for jingles;
- [SLDTMFConfig](#) – for DTMF tones.

To configure a GPI event, specify:

- the event ID. A prefix is added to the name automatically:
  - WAV\_ – for jingles;
  - DTMF\_ – for DTMF tones;
- the input audio device;
- the cue tone samples:
  - files with audio signal samples – for jingles;
  - cue tone characteristics – for DTMF tones;
- the parameters for detecting cue tones;
- the action which is to be performed by the FDO nAir program;
- a comment explaining the command function.

### 3. Using

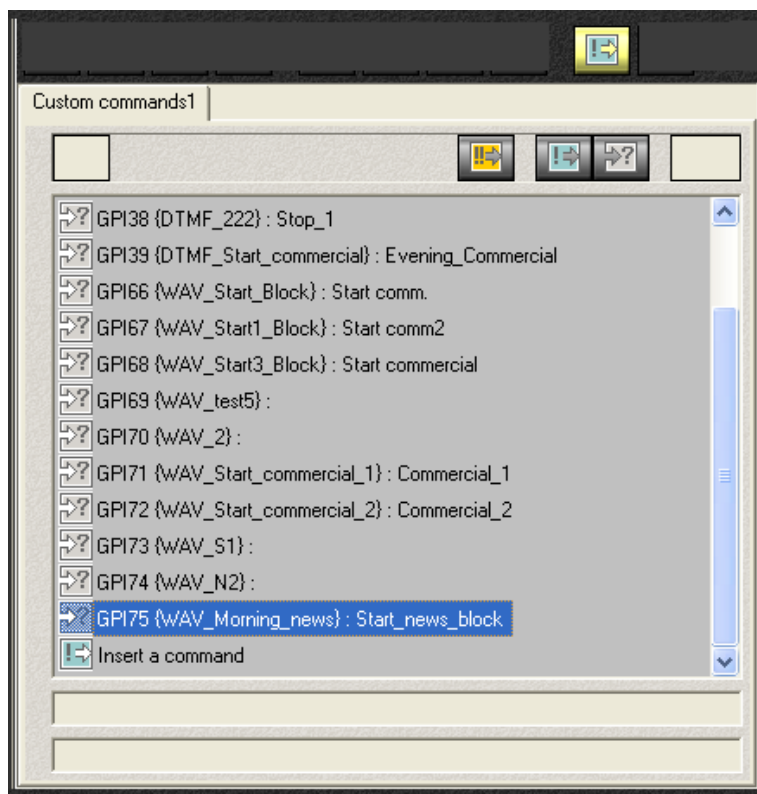
There is a list of special commands on the Custom commands files page of the FDO nAir application. Commands specified when configuring GPI events for working with cue tones are automatically included into the list.

Each line with a command on the page has the following format: GPINum {GPI\_ID} : Name

where:

- GPINum denotes the signal number (set automatically), e.g.: GPI37;
- GPI\_ID – the identifier of the corresponding GPI event (automatically parenthesized in curly brackets), e.g.: {WAV\_Start1} or {DTMF\_3\_Comm};
- : – a required separator (added automatically);

- Name – the command name: a text explaining its function.

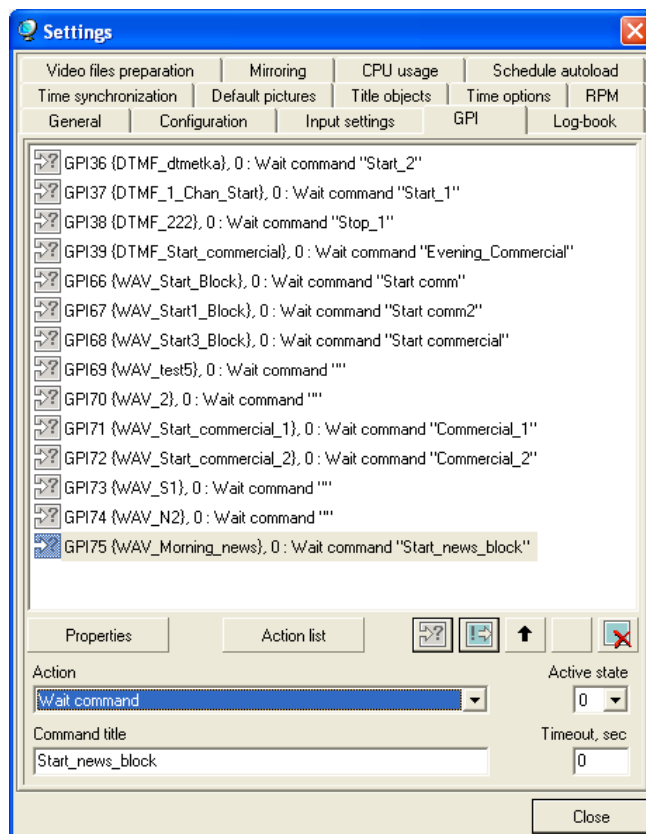


Commands working with cue tones are added to the schedule from the Custom commands files page.

Сост.	Старт	Длина	Имя
READY	5:45:05.00	0:00:01.00	3
READY	5:45:06.00	0:00:01.00	3
	5:45:06.00	0:00:10.14	3
	5:45:16.11	0:00:16.01	3
	5:45:32.09	0:00:16.14	3
	5:45:48.20	0:00:09.13	3
	5:45:58.05	0:01:04.23	3
	5:47:03.00	0:00:35.20	3
	5:47:38.17	0:00:32.01	3
	5:48:10.15	0:00:16.01	3
	5:48:26.14	0:00:01.00	3
	5:48:27.14	0:00:01.00	3
	5:48:27.14	0:00:01.00	3
	5:48:28.14	=0:03:23.14	+0:11:31.10
	6:00:00.00	+19:16:46.02	125
	6:00:00.00	0:00:01.00	3
	6:00:00.22	0:00:01.00	3



It is possible to change the configuration of a command: to specify another name or assign another action to the current GPI event. This can be done on the GPI tab of the FDO nAir Settings window.

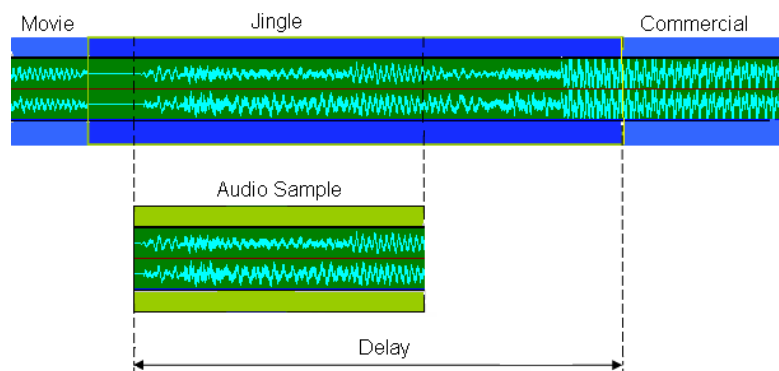


## Detecting Jingles

### 1. Audio Sample

To detect a jingle starting or ending a block of commercials, the detecting module continuously monitors the input audio signal comparing it with the audio sample.

An audio sample is a jingle fragment (WAV file) previously prepared by the user for detecting.



An interval between the jingle detection and the command execution is set by the user via the **Delay** parameter. The delay time is the time from the start of the audio sample to the start of the block of commercials.

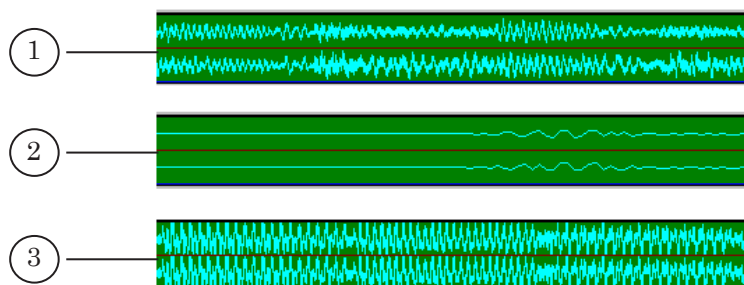
All characteristics of the input signal must be considered in the audio sample including the noise arising when the signal passes from the source to the broadcasting computer. Every sound section has its features. Noise and clutter of various kinds are overlaid on the audio signal when passing through different sound channels, so one and the same sound channel should be used when preparing an audio sample as well as when broadcasting.

- ✓ **Important:** Recording must be performed on the same equipment that will be used to receive the signal when further broadcasting.

As an audio sample, select the most characteristic segment of the jingle. The fragment duration must be no less than 1 s. The sound volume must not be too low or too high. The wave image must be in the range from 20 to 95% of the track height.

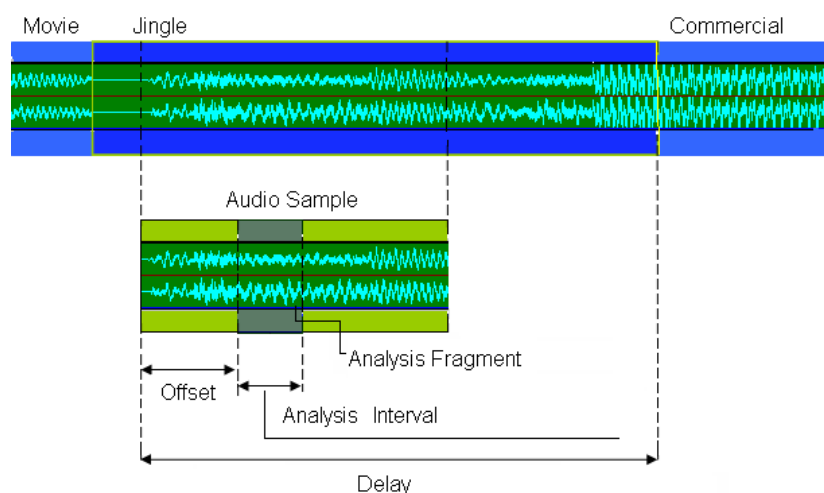
The Figure below shows three different by quality fragments of jingles:

- optimal (1);
- not good for detecting, as the sound is too low (2);
- not good for detecting, as the sound is too high, goes off-scale (3).



## 2. Analysis Fragment

To compare the input signal and the audio sample, a small segment of the audio sample, – analysis fragment, – is used. The fragment duration is in the range from 0.3 to 1 s.



The user specifies which fragment will be selected for detecting by setting its initial position (Offset) and duration (Analysis interval).

The analysis fragment position is set relative to the beginning of the audio sample, that is the offset from the beginning of the audio sample to the analysis fragment is specified.

Changing the analysis fragment position and duration, the user can select a segment of the audio sample best for detecting.

### 3. Detecting Algorithm

The detecting module performs compare as follows:

1. Extracts a fragment of the input audio signal;
2. Calculates the coefficient of similarity between the two fragments – the fragment come for the detection and the audio sample;
3. Makes a decision on the similarity between the input signal and audio sample: if the coefficient exceeds the Threshold value, the selected fragment is considered as matched the audio sample, otherwise – different from the audio sample.
4. The fragment matched the audio sample is identified as the jingle.

### 4. Coefficient of Similarity

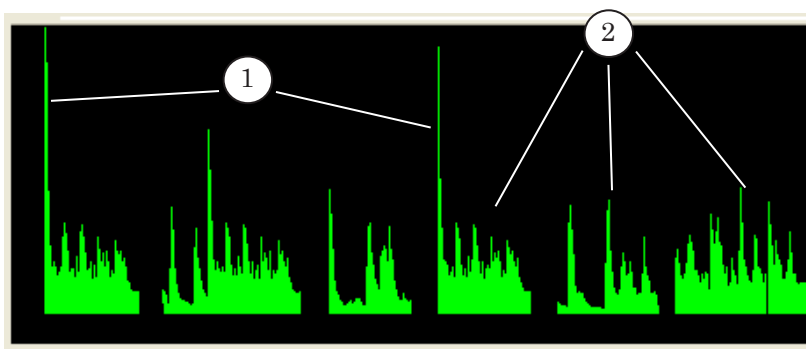
The coefficient of similarity is a measure of similarity between two audio fragments. The detecting program uses the coefficient to make a decision if the input signal belongs to jingles.

The coefficient of similarity can take values from 0 to 100%. The more the similarity of the fragments the higher the coefficient value.

### 5. Coefficient of Similarity Time Series

As the input signal changes in the course of time, the program continuously selects new fragments to compare with the audio sample. Thus the pairwise comparison is performed repeatedly. Consequently, one's own coefficient of similarity between the input signal and the audio sample is calculated for each moment of time.

A time-ordered resulting set of the coefficient of similarity values can be presented as a graph. An example of such a graph is shown in the Figure below: in some moments of time (1) the coefficient of similarity is high – the values are close to 100%; in others (2) – the values are low, approximately 30% and under.





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## 6. Detecting Parameters

The quality and speed of detecting jingles are controlled by the following parameters:

1. Sample rate when processing the signal.
2. The analysis fragment characteristics: duration (Analysis interval) and the signal qualitative characteristics on the current segment.
3. The threshold level of similarity required when making a decision on the similarity between the signal and the audio sample (Threshold).
4. Cutoff frequency for the high-frequency filter. The filter is used for the low-frequency noise suppression (in particular, the industrial frequency of 50 Hz).
5. Low-frequency filter size (Low-pass filter size). The filter is used to suppress (in the audio sample) the frequency over the specified sample rate.
6. The regularity of recalculating the rating coefficients (Power recal rate).



## Guidelines on Selecting Parameter Values for Detecting Jingles

### 1. Sample Rate

This parameter sets the sample rate used when processing the signal being detected.

The higher the parameter value, the more the oscillation amplitude of the coefficient of similarity values: higher when the jingles pass, lower for other audio fragments.

However, the lower the **Sample rate** value, the less is the processor load when analysing audio.

The parameter value range is limited and depends on the sample rate of the used audio device.

- ✓ **Important:** The audio device sample rate must be multiple of the rate specified in the **Sample rate** parameter!  
For example, if a sample rate of 48000 Hz is set for the audio device, the available sample rate when detecting (the **Sample rate** parameter) is 8000, 16000, or 24000 Hz.

### 2. Position of the Analysis Fragment (Offset)

The position of the analysis fragment is set by specifying the offset from the beginning of the audio sample to the beginning of the fragment. Changing the offset, it is possible to select a segment of the audio sample best for detecting.

When fitting the initial position of the analysis fragment, note that the latter must be within the audio sample.

### 3. Duration of the Analysis Fragment (Analysis interval)

The more the duration of the analysis fragment, the more accurate is detection, but then the more time passes from the beginning of the jingle to the moment of the GPI triggering.

The less the parameter value, the faster the calculations are performed, the faster the detecting goes, but then the accuracy of detection drops.

The duration of the analysis fragment can not be set arbitrarily, but depends on the selected **Sample rate**:

Analysis interval =  $\text{Sample rate} \cdot 2^N$ , where  $N=0, 1, 2\dots$

- ✓ **Important:** The parameter value is limited as follows: the duration of the analysis fragment must be no less than 0.3 s and no more than 1 s.



#### 4. Threshold Level of Similarity (Threshold)

The threshold level of similarity is used to make a decision on the similarity between the signal and the audio sample.

If the coefficient of similarity value exceeds the specified threshold value, the selected fragment is considered as matched the audio sample, otherwise – different from the audio sample.

The higher the threshold level, the fewer misoperations when detecting. However, when the threshold level is too high, some of the jingles may be not detected.

Lowering the threshold means lowering the requirements for the similarity of fragments, that is the jingle is to be recognized even in the presence of strong noise, but then the probability to take an unwanted signal for the jingle increases.

✓ **Important:** It is not recommended to set the similarity threshold value less than 40–50%.



## Preparing Audio Samples of Jingles

### 1. Sequence of Operations

Preparing an audio sample for detecting a jingle includes the following steps:

1. Recording a fragment of broadcast with the jingle to an AVI file. To do this, you may use the FDCapture program included into the Forward T software package.

✓ **Important:** Recording must be performed on the same equipment that will be used to receive the signal when further broadcasting.

2. Creating an audio sample based on the prepared AVI file, that is selecting the most characteristic segment of the audio record and saving it to a WAV file.
3. Fitting the analysis fragment and the parameter values:
  - a) the delay time (from the beginning of the audio sample to the beginning of the commercial) – the Delay parameter;
  - б) the initial position of the analysis fragment – the Offset parameter;
  - в) the duration of the analysis fragment – the Analysis interval parameter.

Steps 2 and 3 can be performed in the Forward AV Studio program from the Forward T software package.

### 2. Estimating the Volume Level of the Audio Sample

It is possible to exactly estimate [the volume level of the audio sample](#) in the Forward AV Studio program using the Sound Statistics window. To open the window, select Command > Statistics... in the main program menu.

Total Samples, Time		2 736		00 : 057 ms	
Clipped Samples		0 (0.000%)		0 (0.000%)	
		Left Channel		Right Channel	
Positive Max Level	-4.81	18836.6	-6.37	15729.1	
Negative Max Level	-2.76	-23843.1	-6.34	-15792.4	
Average Level	-15.45	5533.9	-17.29	4474.9	
Average RMS Level	-13.34	7054.5	-15.38	5577.8	
	dB	value	dB	value	
DC Offset (% , value)	-1.951	-639.4	-1.095	-358.9	



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For an optimal fragment:

- the number of clipped samples (the values in the Clipped Samples fields (1)) must be equal to 0;
- the values indicated in the Positive Max Level and Negative Max Level (2) fields must be in the range of -12 to -1 dB.



## Detecting DTMF Tones

### 1. Characteristics of the DTMF Tone

To detect a DTMF tone, the detecting module continuously monitors the input audio signal, recognizing sound combinations with the specified characteristics.

The characteristics of the DTMF tone are previously specified by the user when configuring a GPI event. Information of them must be provided by the headend broadcasting station. A DTMF tone has the following characteristics:

- the signal code is a symbol string forming the DTMF tone (Cue-tone (DTMF) signal);
- the duration of each symbol (Symbol duration);
- the duration of gaps between the symbols (Gap duration).

The time from the beginning of the DTMF tone to the start of the block of commercials is referred to as a response delay (Delay) and set when configuring the GPI event as well.

### 2. Detecting Parameters

When detecting DTMF tones, use a parameter that sets the accuracy of determining the durations of the symbols and gaps in milliseconds (Deviation).

- ✓ **Important:** The Deviation parameter values must be no less than 10 ms and no more than 1/2 of the durations of the symbols and gaps.

## The SLJingleConfig Program

### 1. Function

The program is intended to create and configure [GPI events](#) used when working with jingles.

A GPI event determines the action which is to be performed [when a specified jingle at the audio input is detected](#). The names of such GPI events have the WAV\_ prefix.

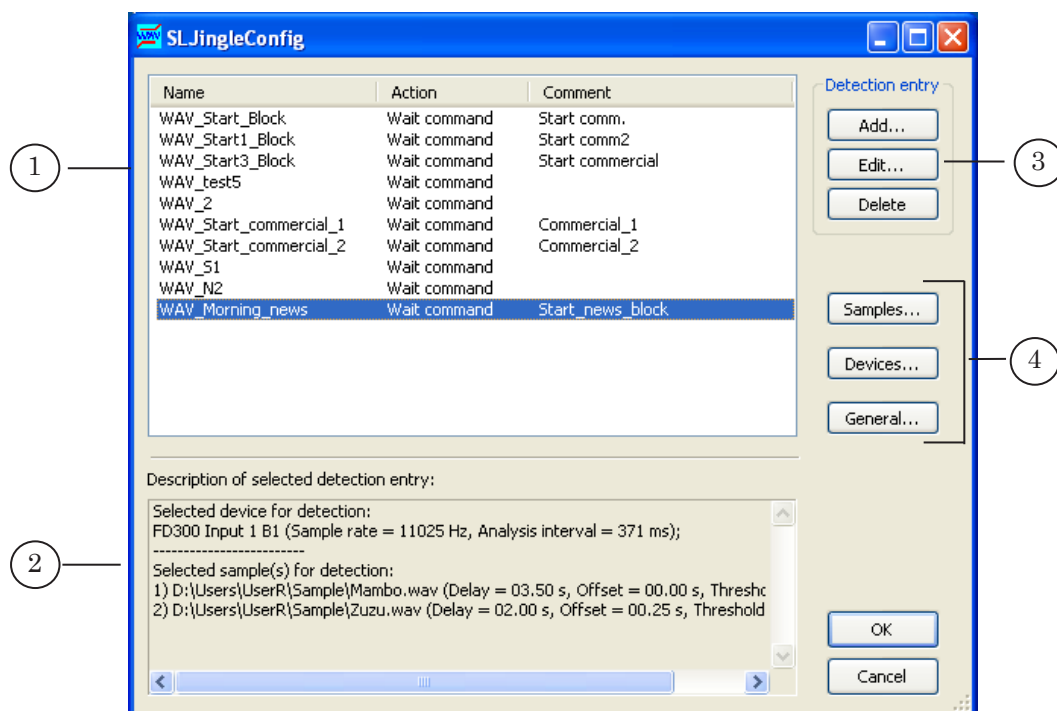
### 2. The Main Program Window

To launch the program, select

C:\Program Files\ForwardT Software\AutoDetect\SLJingleConfig.exe

The main program window contains controls used for the following purposes:

- to get information of the existing events;
- to edit their parameters;
- to configure new events.



The Main Program Window

1 – the list of GPI events; 2 – information of the selected event; 3 – buttons for working with events; 4 – buttons for presetting.

The list of GPI events (1) contains all events existing in the system for jingles. The list indicates for each event:

- Name;
- Action – the action assigned;
- Comment.

The Description of selected detection entry information pane (2)

displays complete information of the parameter values of the event selected in the list.

The Detection entry area buttons (3) are intended to work with events:

- Add... – to create a new event;
- Edit... – to edit the parameters of the selected event;
- Delete – to delete the selected event.

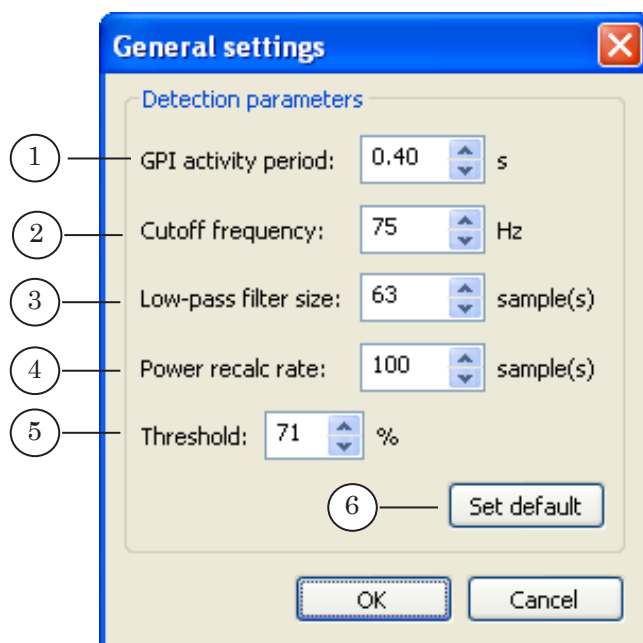
The following buttons are used to perform presetting (4):

- Samples... – to proceed to setting [the audio samples](#);
- Devices... – to proceed to setting the configurations of the input devices;
- General... – to proceed to setting [the general detecting parameters](#).

The OK button is intended to save the changes and exit the program. Click Cancel to exit the program without saving changes.

### 3. Setting the General Parameters

The General settings window is intended to set the values of the general parameters for detecting jingles. Click the General... button in the main program window. The General settings window opens.



The values of the detecting parameters are set in the following fields:

- GPI activity period (1) – the time when the GPI signal is active (closed) in seconds;
- Cutoff frequency (2) – the cutoff frequency for the high-frequency filter (in Hz);

- Low-pass filter size (3) – the low-pass filter length (in signal samples);
- Power recalc rate (4) – the regularity of recalculating the rating coefficients;
- Threshold (5) – the threshold level of similarity for the audio fragments, which is to be used in the program as a default (in per cent).



**Tip:** It is not recommended to change the default values in the Cut-off frequency, Low-pass filter size, Power recalc rate fields without necessity.

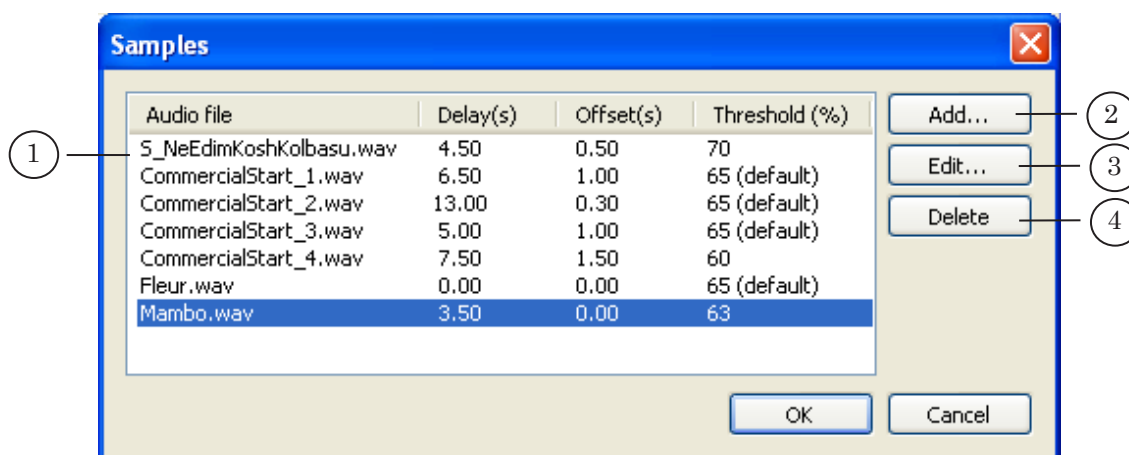
The Set default button is used to set the defaults.

The OK button is intended to save the changes and return to the main program window. Click Cancel to exit the program without saving changes.

#### 4. List of the Audio Samples

The Samples window is intended to set [the audio samples](#). To open the Samples window, click the Samples... button in the main program window.

The window displays information of the existing audio samples. It is possible to configure new audio samples.



The list of the audio samples is presented as a table (1). The Audio file column displays the WAV file names; the others – the current parameter values of each sample ([see below](#)).

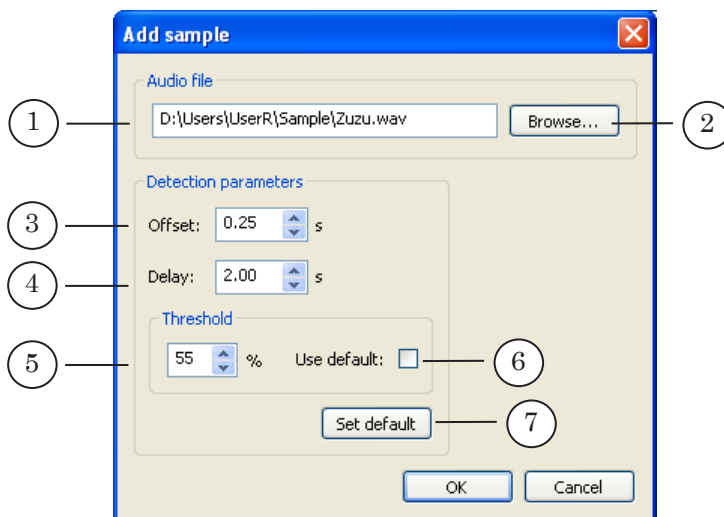
To edit the list, use the following buttons:

- Add... (2) – to add a new sample;
- Edit... (3) – to change the settings of the selected sample;
- Delete (4) – to delete the selected sample.

The OK button is intended to save the changes and return to the main program window. Click Cancel to return without saving

changes.

Click the Add... button to open the Add sample window intended to set the parameters of a new sample. Click the Edit... button to open the Edit sample window for editing the selected sample parameters. The two windows are analogous in the composition and function of the controls.



The text field under Audio file (1) is used to specify the full path to the WAV file with [an audio sample](#). Use the Browse... button to open the standard file open dialog box (2).

The text fields under Detection parameters and Threshold are used to set the parameter values for the selected file:

- Offset (3) – the interval setting the position of [the analysis fragment](#) in the sample;
- Delay (4) – the interval determining [the triggering delay time of the GPI command](#);
- Threshold (5) – [the threshold level of similarity](#) used when detecting.

Check the Use default check box (6) to set the default threshold value specified in the General settings window.

Use the Set default button (7) to set the defaults for all the parameters.

## 5. Configurations of the Input Devices

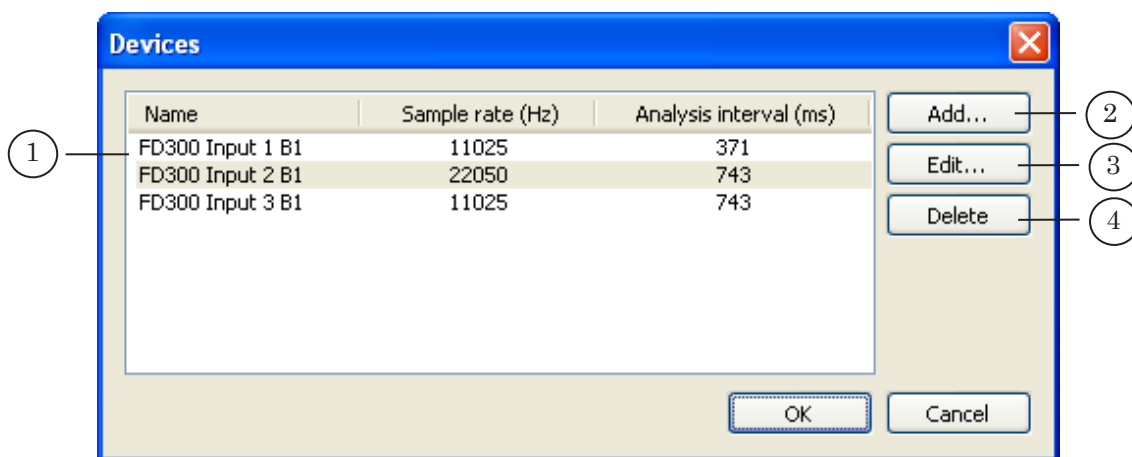
The Devices window is intended to set the list of the input devices. To open the window, click the Devices... button in the main program window.

Concurrently with selecting devices, set the detecting parameters whose values must be fit considering the sample rate of the input device used.

Each configuration set in the window includes the following

parameters:

- Name is the input device name;
- Sample rate used when detecting;
- Analysis interval is the duration of the analysis fragment.

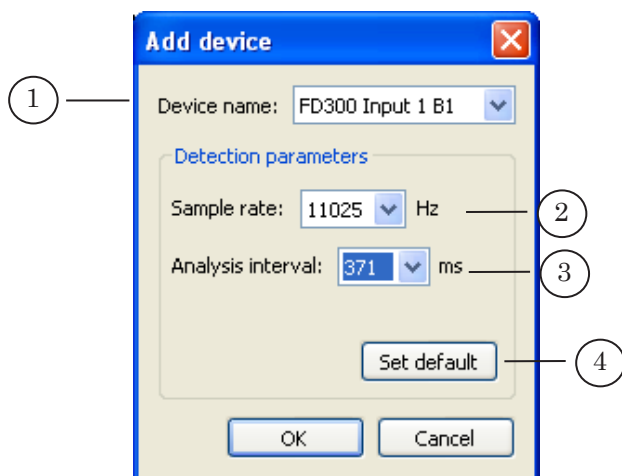


The window displays the list of the existing configurations (1). To edit the list, use the following buttons:

- Add... (2) – to add a new variant;
- Edit... (3) – to change the parameter values for the selected configuration;
- Delete (4) – to delete the selected variant.

The OK button is intended to save the changes and return to the main program window. Click Cancel to return without saving changes.

Click the Add... button to open the Add device window intended to set a new configuration. Click the Edit... button to open the Edit device window for editing the selected configuration parameters. The two windows are analogous in the composition and function of the controls.



The values of the parameters in the Add device window are selected in the following drop-down lists:

- Device name (1) – the input device to perform detecting. The list contains only the devices available to use;
- Sample rate (2) [used when detecting](#) (in Hz). The list contains only the values available for the selected device;
- Analysis interval (3) – [the duration of the analysis fragment](#) (in ms). The list contains only the values available for the selected sample rate.

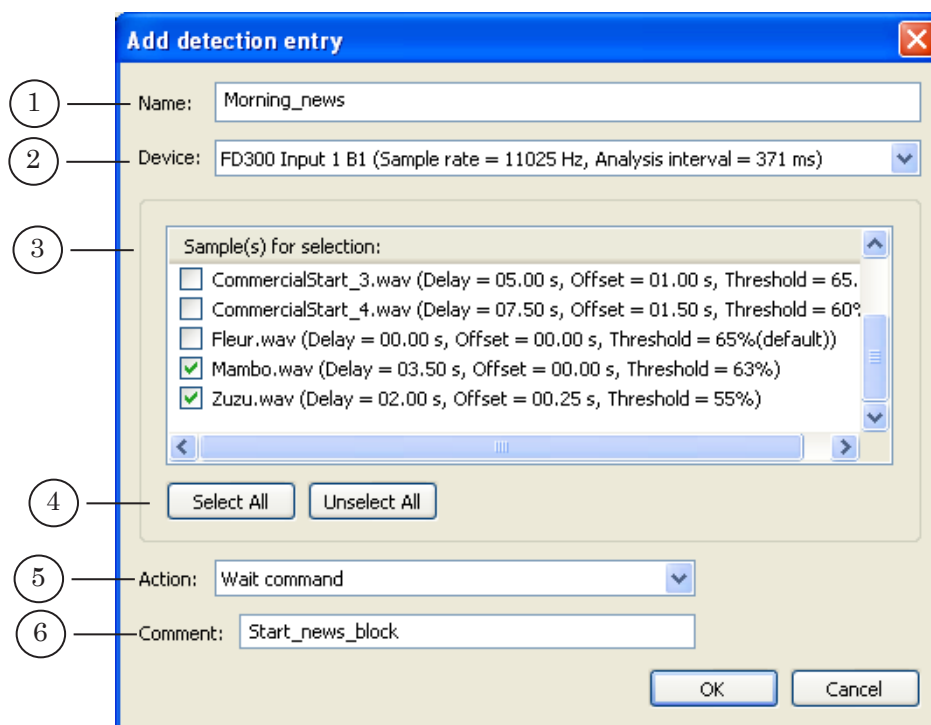
Use the Set default button (7) to set the defaults for all the parameters.

Click OK to add the new configuration to the list. Click Cancel to close the dialog without saving changes.

## 6. Setting a GPI Event

[Setting a GPI event](#) is performed in the Add detection entry window (for a new event) or Edit detection entry window (for an existing event). The two windows are analogous in the composition and function of the controls.

To open the window, click Add... (or Edit... respectively) in the Detection entry area of the main program window.



To set an event, use the following controls:

- the Name field (1) – to specify the event ID;
- the Device drop-down list (2) – to select a configuration of the input device;
- the Sample(s) for selection list (3) – to select jingle samples. To select, check the required check box;
  - the Select All and Unselect All buttons (4) – allow you to check/uncheck all the check boxes in the list;
- the Action drop-down list (5) – to select an action (FDOnAir commands) which is to be performed by the event;
- the Comment field (6) – a text explaining the command function.

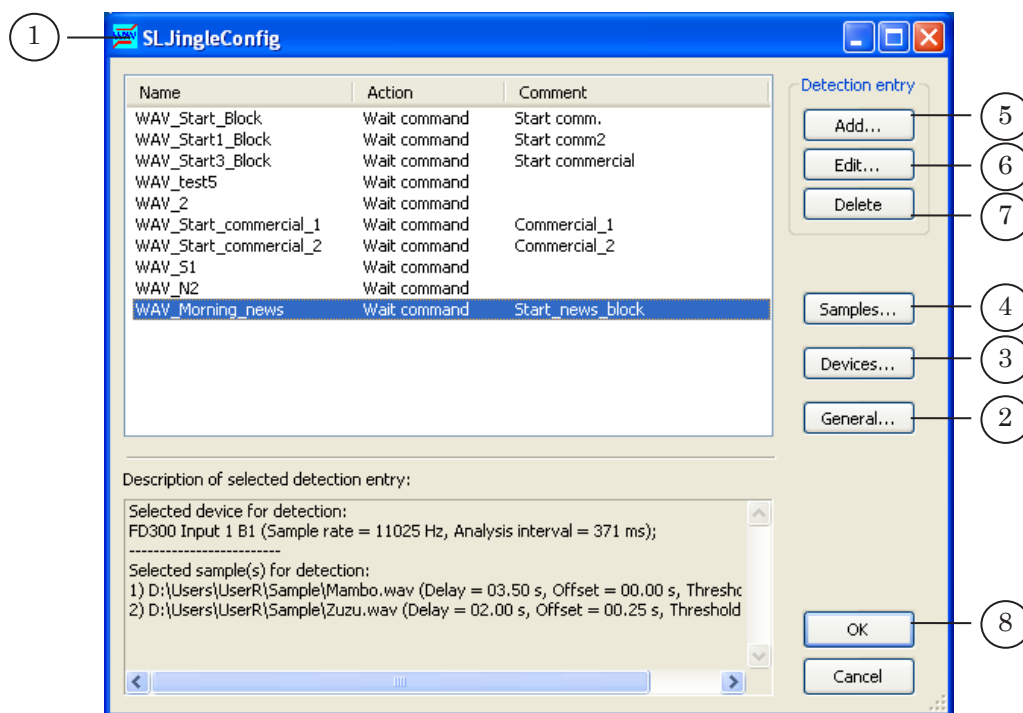


## 7. Working with this Program

- ✓ **Important:** First of all make sure the FDO nAir program is closed.

Working with the program includes the following steps:

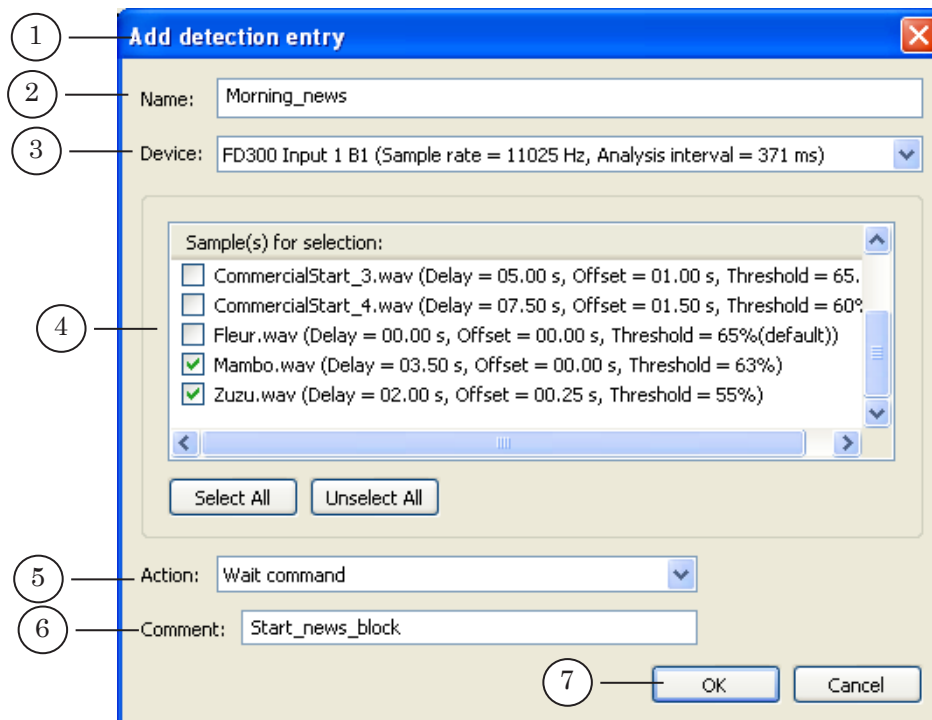
1. To launch the SLJingleConfig program, select  
C:\Program Files\ForwardT Software\AutoDetect\SLJingleConfig.exe



2. Set the general parameters for detecting: click the General... button. The General settings window opens. Make the settings.
3. Set the configurations of the input devices: click the Devices... button. The Devices window opens. Make the settings.
4. Set the list of the audio fragments: click the Samples... button. The Samples window opens. Make the settings.
5. Add a new [GPI event](#): click the Add... button and set the event parameters.
6. Any GPI event of the list can be edited: select a required event and click Edit....
7. To remove a selected event, click Delete.
8. To exit the program with the changes saved, click OK.

Setting the parameters of a new event is performed as follows:

1. Click the Add... button. The Add detection entry window opens.



2. Specify the event name in the Name field.
3. Select a configuration of the input device in the Device drop-down list.
4. Select audio samples in the Sample(s) for selection list: check the required check boxes.
5. Select an action in the Action drop-down list.
6. Specify a comment in the Comment field.
7. Click OK.

## The SLDTMFConfig Program

### 1. Function

The program is intended to create and configure [GPI events](#) used when working with DTMF tones.

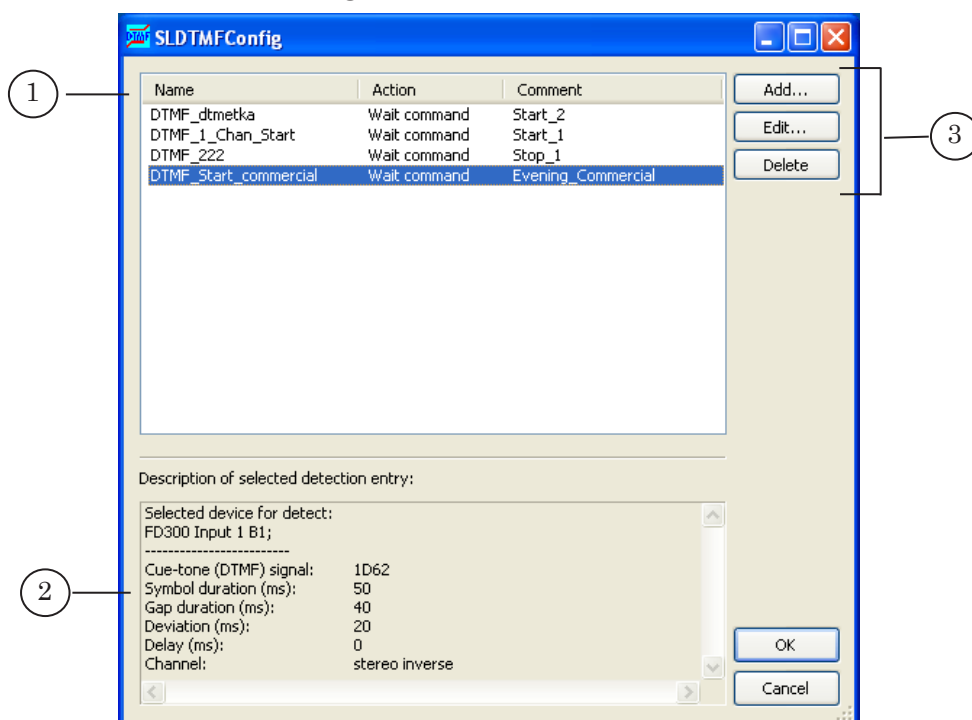
A GPI event determines the action which is to be performed [when a specified DTMF tone at the audio input is detected](#). The names of such GPI events have the DTMF\_ prefix.

### 2. The Main Program Window

To launch the program, select  
C:\Program Files\ForwardT Software\AutoDetect\SLDTMFConfig.exe

The main program window contains controls used for the following purposes:

- to get information of the existing events;
- to edit their parameters;
- to configure new events.



The Main Program Window

1 – the list of GPI events; 2 – information of the selected event; 3 – buttons for working with events.

The list of GPI events (1) contains all events existing in the system for DTMF tones. The list indicates for each event:

- Name;
- Action – the action assigned;
- Comment.

The Description of selected detection entry information pane (2)

displays complete information of the parameter values of the event selected in the list.

The following buttons are intended to work with the events (3):

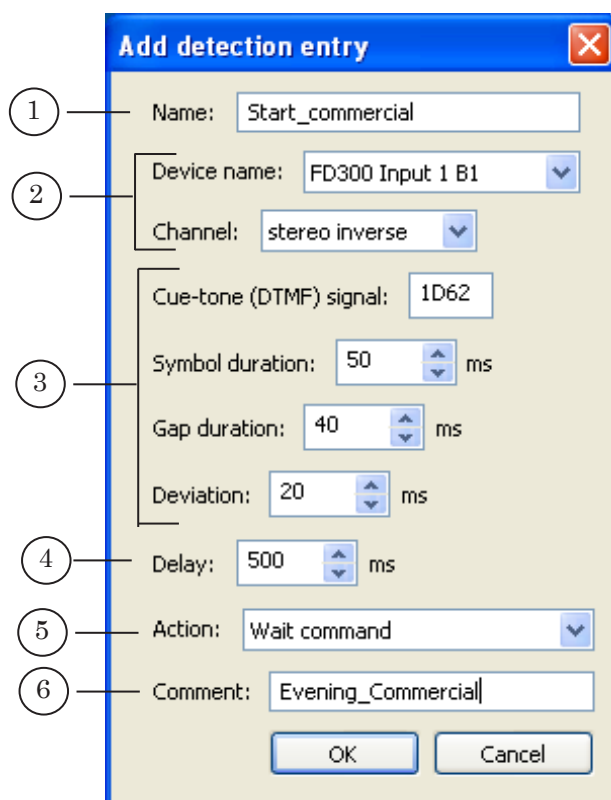
- Add... – to create a new event;
- Edit... – to edit the parameters of the selected event;
- Delete – to delete the selected event.

The OK button is intended to save the changes and exit the program. Click Cancel to exit the program without saving changes.

### 3. Setting a GPI Event

Setting a GPI event is performed in the Add detection entry window (for a new event) or Edit detection entry window (for an existing event). The two windows are analogous in the composition and function of the controls.

To open the window, click Add... (or Edit... respectively) in the main program window.



To set an event, use the following controls:

- the Name field (1) – to specify the event ID;
- drop-down lists to select the input device and channel (2):
  - Device name;



- Channel – the channel via which the cue tone comes. The list enumerates the possible values: left, right, stereo, stereo inverse;
- fields to set [the characteristics and parameters for detecting the cue tone](#) (3):
  - Cue-tone (DTMF) signal – a sequence of symbols constituting the cue tone;
  - Symbol duration – the duration of each symbol (in ms);
  - Gap duration – the duration of gaps between the symbols (in ms);
  - Deviation – the accuracy of determining the durations of the symbols and gaps (in ms);
- the Delay field (4) – to set the triggering delay of the GPI command (in ms);
- the Action drop-down list (5) – to select an action which is to be performed by the event in FDO nAir;
- the Comment field (6) – a text explaining the command function.

The OK button is intended to save the changes and return to the main program window. Click Cancel to exit the program without saving changes.

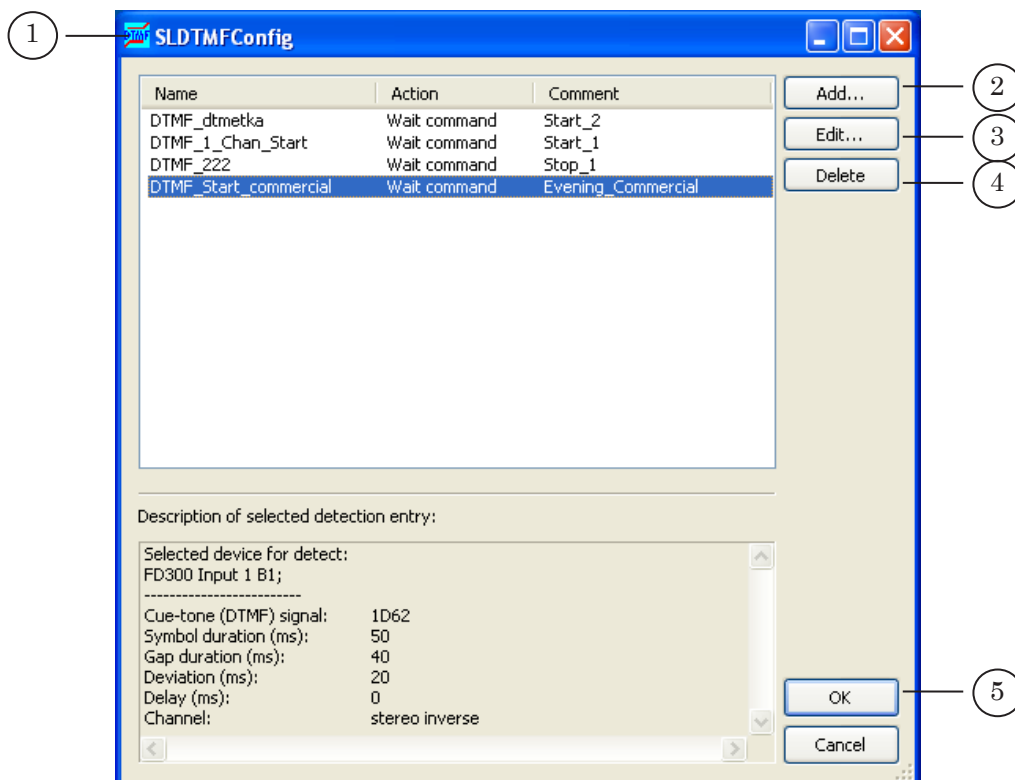


## 4. Working with this Program

- ✓ **Important:** First of all make sure the FDOAir program is closed.

Working with the program includes the following steps:

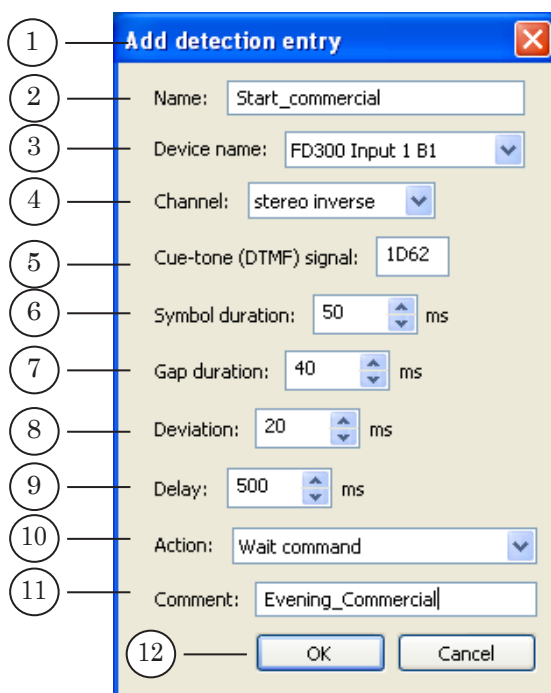
1. To launch the SLDTMFConfig program, select  
C:\Program Files\ForwardT Software\AutoDetect\SLDTMFConfig.exe



2. Add a new [GPI event](#): click the Add... button and set the event parameters.
3. Any GPI event of the list can be edited: select a required event and click Edit...
4. To remove a selected event, click Delete.
5. To exit the program with the changes saved, click OK.

Setting the parameters of a new event is performed as follows:

1. Click the Add... button. The Add detection entry window opens.



2. Specify the event name in the Name field.
3. Select an input device in the Device name drop-down list.
4. Using the Channel drop-down list, select an audio channel via which the cue tone comes.
5. In the Cue-tone (DTMF) signal field, enter a sequence of symbols constituting the cue tone.
6. In the Symbol duration field, set the symbol duration for each symbol of the cue tone.
7. In the Gap duration field, set the gap duration between the symbols.
8. In the Deviation field, set the accuracy of determining the durations of the symbols and gaps.
9. In the Delay field, set the interval duration between the beginning of the DTMF tone and the start of the block of commercials.
10. Using the Action drop-down list, select an action which is to be performed by the event.
11. In the Comment field, enter a text explaining the command function.
12. Click OK.



## The SLJingleTuning Program

### 1. Function

The SLJingleTuning program is intended to estimate the quality of [the audio samples](#) (adequacy for detecting) and fitting the optimal [parameters for detecting jingles](#).

The program works with [the GPI events](#) previously created in [the SLJingleConfig](#) program. When configuring events, selecting audio samples and initially tuning the detecting parameters is performed.

Optimization of the detecting procedure implies:

1. The reduction of the the resource consumption for detecting jingles:
  - time (the faster is the detection, the better);
  - the system resource (CP).
2. Avoidance of the loss of the accuracy of detection, that is minimization of nonrecognitions and misrecognitions.

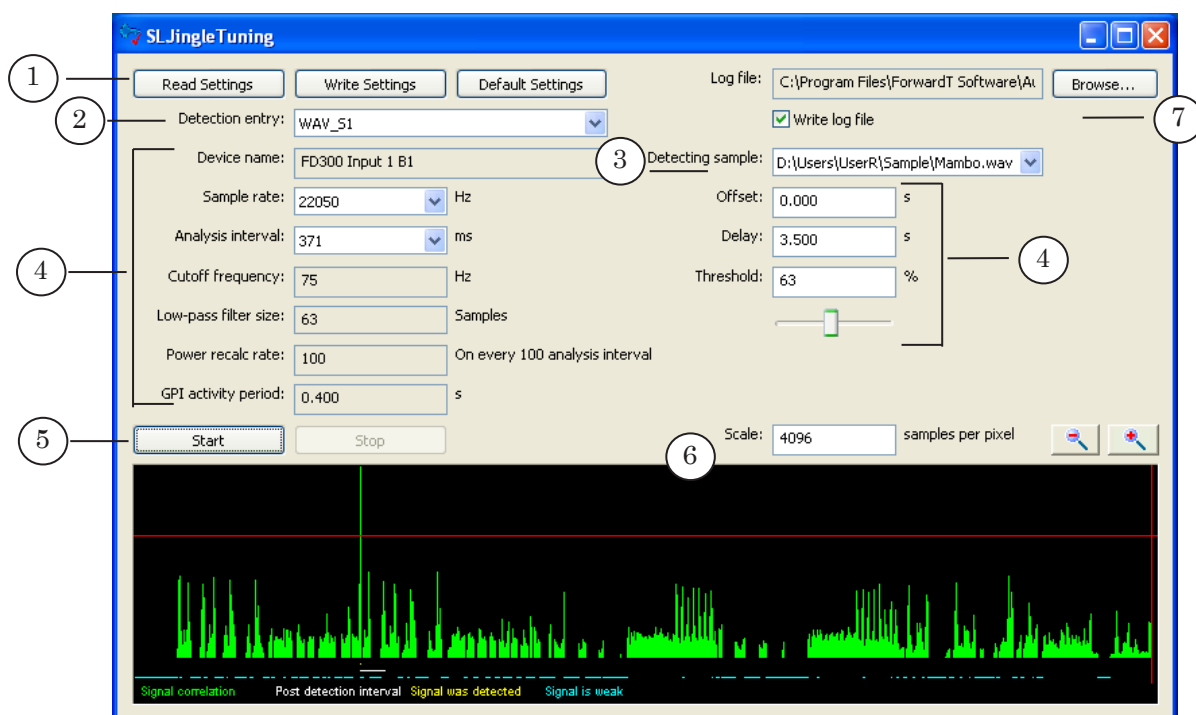
Using the program, you can estimate the quality of detecting in two ways: visually and on the basis of the statistics accumulated in the log file.

### 2. The Main Program Window

To launch the program, select  
C:\Program Files\ForwardT Software\AutoDetect\SLJingleTuning.exe

The main program window contains controls used for the following purposes:

- to adjust parameters experimentally;
- to visually estimate the result of changing the settings;
- to perform continuous testing along with logging the actions of detecting jingles;
- to save the optimal settings for further work.



### The Main Program Window

1 – buttons for loading and saving the detecting settings; 2 – a list for selecting a GPI event; 3 – a list for selecting an audio sample; 4 – controls for displaying and setting parameters; 5 – buttons for starting and stopping the testing process; 6 – the graph of the coefficients of similarity; 7 – controls for setting the logging process.

To control the settings of the detecting parameters, use the following buttons (1):

- Read Settings – to load the current parameter values from the Registry into the window;
- Write Settings – to write the new parameter settings into the Registry;
- Default Settings – to load the defaults into the window.

The window displays information of the parameters of one [GPI event](#) selected for setting. When pressing the Read Settings button, information of the current settings of the first (in the Registry list) GPI event and the first audio sample of the event is loaded into the corresponding fields. When another event or audio sample is selected, the information is automatically updated.

To select a GPI event and audio sample, use the following drop-down lists:



- Detection entry (2) – to select an event;
- Detecting sample (3) – to select an audio sample.

Controls for displaying and editing the detecting parameter values are located in the parameter settings area (4). The controls are discussed in [the next Section](#).

To control testing, use the following buttons (5):

- Start – to start the test detection;
- Stop – to stop the testing.

The area for visual estimation of the quality of detecting (6) contains:

- the graph of [the time-ordered coefficients of similarity](#);
- controls for setting the scale:
  - the Scale text field – the current scale (the number of samples per pixel);
  -  – increase the scale;
  -  – decrease the scale.

To set the logging, use the following area (7):

- the Log file text field – displays the full path to the log file;
- the Browse... button – to select or specify a log file in the standard file open dialog box;
- the Write log file check box – to enable/disable the test logging.

The log file automatically records all the cases of the jingle detector triggering along with the indication of time and the coefficient of similarity. The log file can be used when continuously testing to make a decision of the detection quality.

### 3. Controls for Displaying and Setting Parameters

Using the controls of this group, you can view and change the [detecting settings](#) for the selected [GPI event](#) and [audio sample](#). Changing the settings influences only the experimental detecting and does not affect the current parameter values.

To change the current settings of the detecting module, save the new parameter values to the Registry. For that, click the Write Settings button.

✓ **Important:** When switching from one GPI event to another, all the changes in the settings that are not saved to the Registry are discarded.

To set the detecting parameters, use the following controls in the main window:

- for the parameters depending on the input device characteristics, use the following drop-down lists:
  - Sample rate [used when detecting](#) (in Hz). The available range of the parameter values depends on the sample rate of the selected audio device (the list contains only the values the device sample rate is multiple of);



- Analysis interval – [the analysis fragment duration](#) (in ms). The available range of the parameter values depends on the sample rate selected for detecting;

✓ **Important:** It is recommended to set the analysis fragment duration no less than 0.3 s. Note again that the duration must not exceed 1 s.

- for the parameters referring to the audio sample, use the following text fields:
  - Offset – the interval (in seconds) specifying [the position of the analysis fragment](#) in the sample (from the beginning of the audio sample);
  - Delay – the interval (in seconds) determining [the delay time](#) from the recognition of the jingle to the GPI command triggering (from the beginning of the audio sample to the beginning of the block of commercials);
  - Threshold – [the threshold level of similarity](#) (in per cent), used when making a decision on the similarity between the signal and audio sample. Setting the parameter can also be performed with the slider located alongside.

✓ **Important:** It is not recommended to set the threshold level of similarity below 40–50%.

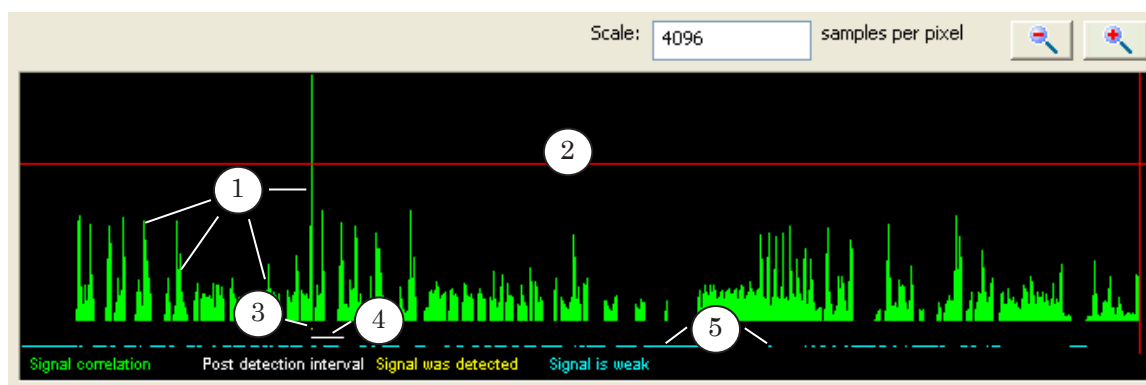
The text fields listed below are used to display supplemental information of the other settings of the GPI event. Those settings cannot be changed in the SLJingleTuning program:

- Device name – the name of the input audio device;
- Cutoff frequency – the cutoff frequency for the high-frequency filter (in Hz). A high-frequency filter is used for the low-frequency noise suppression (in particular, the industrial frequency of 50 Hz);
- Low-pass filter size – the size of the low-frequency filter (in signal samples). A low-frequency filter is used to suppress in the audio sample the frequency over the specified sample rate;
- Power recalc rate – the regularity of recalculating the rating coefficients;
- GPI activity period – the time (in seconds) when the GPI signal is active, i.e., considered looped.

#### 4. Visually Estimating the Quality of Detection

The detecting procedure is displayed in the main program window as a time-ordered graph of the coefficients of similarity.

To set the display scale, use the **Scale** text field and the buttons located alongside.

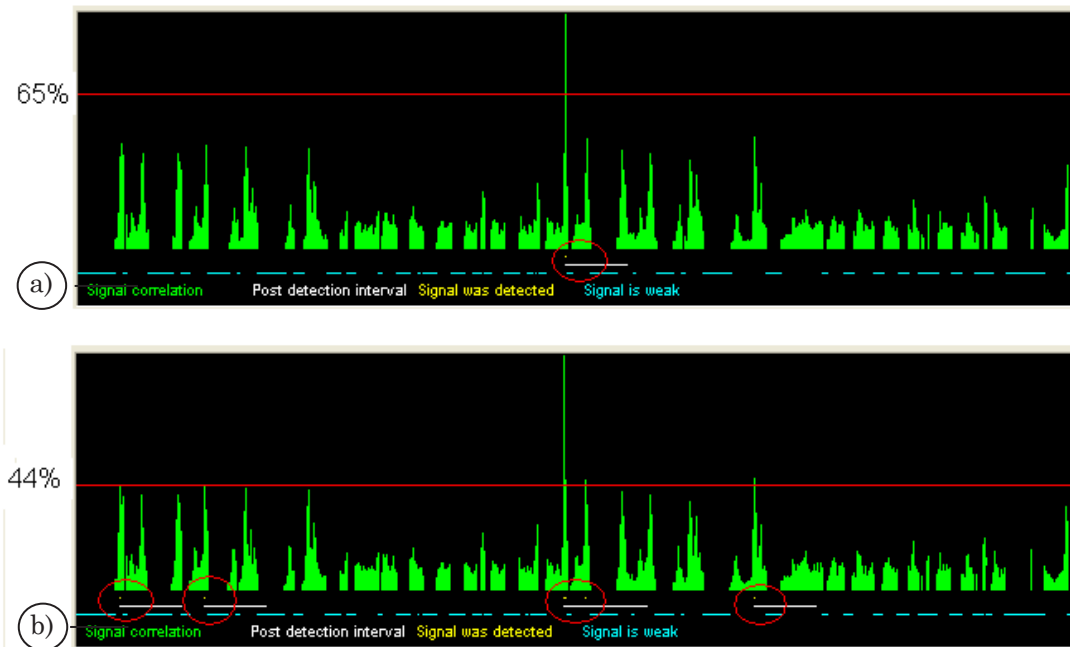


The graph is provided with the following markers:

- Signal correlation (1) – the coefficient of similarity values;
- the red horizontal line (2) – the threshold level of similarity (all the fragments for which the similarity is larger are the jingles);
- Signal was detected (3) – the signal is recognized as the jingle;
- Post detection interval (4) – the GPI signal is active (looped);
- Signal is weak (5) – the signal is too weak, being impossible to use for detection.

The graph allows you to estimate the quality of detecting jingles and the influence of adjusting the parameters on the detection.

The Figure below shows that the number of fragments recognized as the jingle increased when the threshold level of similarity was decreased from 65 (a) to 44% (b).

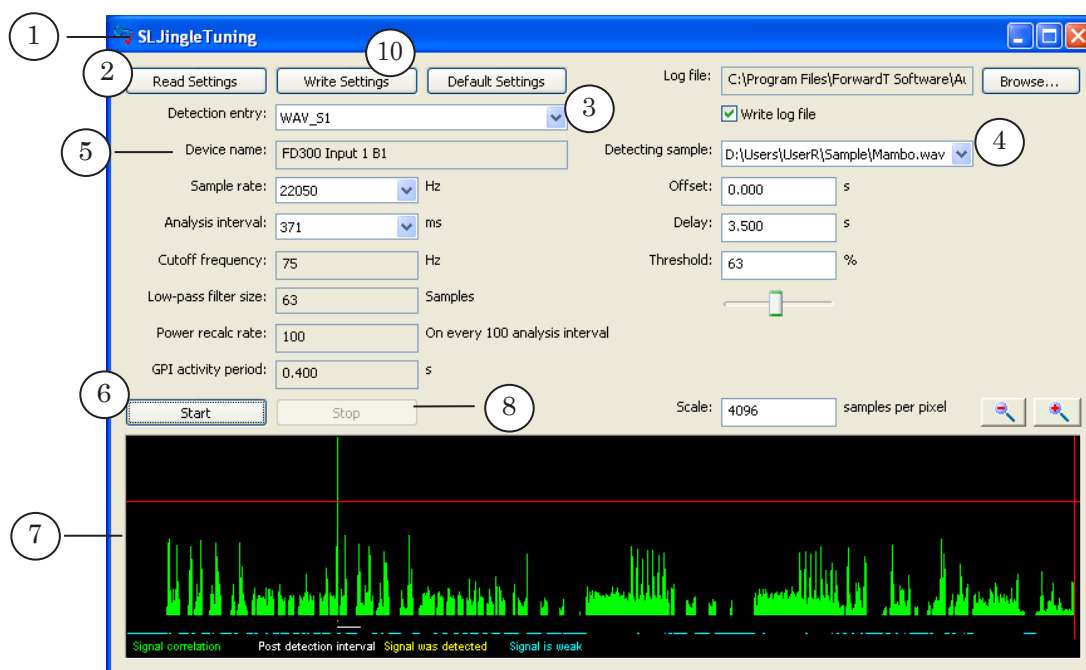




## Working with the SLJingleTuning Program

### 1. General Flowchart

1. To launch the SLJingleTuning utility, select C:\Program Files\ForwardT Software\AutoDetect\SLJingleTuning.exe
  2. To load the current settings from the Registry, click the Read Settings button.
  3. Select a GPI event in the Detection entry drop-down list.
  4. Select a required audio sample in the Detecting sample drop-down list.
  5. Supply the audio signal to the input indicated in the Device name field.
  6. To start testing, click Start.
  7. The graph displays the test result of detecting jingles.
  8. To stop testing, click Stop.
  9. Examine the graph, adjust the detecting parameters, and start testing again.
- Repeat steps 6–9 as many times as required.
10. If you think the optimal settings of the detecting parameters are fit, write them to the Registry. For that, click the Write Settings button.





- ✓ **Important:** The new detecting settings are applied only when they are written to the Registry.  
When another GPI event is selected, all the changes that are not saved are discarded.

When necessary to write the testing results to the log file:

1. Specify the full path to the log file using the Browse... button located next to the Log file text field.
2. Check the Write log file check box.

## 2. General Guidelines on Adjusting Parameters

Optimization of the detecting procedure consists in the accuracy gain when detecting jingles.

The optimization implies solving two tasks:

1. To achieve the coefficient of similarity values to adequately reflect the real situation: when the jingle sounds, the coefficient of similarity value must be the largest possible, when other sounds passing, being the lowest possible.

For that, adjust the following parameters:

- Sample rate – the higher the parameter value, the larger is the oscillation amplitude of the coefficient of similarity values (higher when the jingles pass; lower for other audio fragments);
  - Analysis interval – the larger the parameter value, the more accurate detection.
2. To fit the optimal threshold of the jingle detector triggering (Threshold): select the one when the number of nonrecognitions and misoperations is reduced to a minimum.

To estimate the detecting accuracy, use the graph of the coefficients of similarity located in the main program window.

## 3. Fitting the Analysis Fragment

There may occur a situation when a segment selected as the analysis fragment is not good for the job: the signal on the segment is too weak. In this case, the program displays a warning message, and the user should:

- change the parameters of the analysis fragment by:
  - changing its initial position – Offset;
  - changing its duration – Analysis interval;
- if changing the parameters does not help it, prepare another audio sample.

## 4. Continuous Testing

1. It is recommended to set the similarity threshold 10-20% lower than the optimal.



2. To enable the logging process, check the Write log file check box.
3. To specify a log file, use the Browse... button. The full path to the log file is displayed in the Log file text field.
4. Gathering statistics.  
Start test detection for twenty four hours.  
During the test time, record the occurrences of the analysed jingle on air. Record the jingle receipt time on the input.
5. Analyzing the log file.  
Compare the program log file with your own records and find out:
  1. If all the jingles were recognized.  
Even if the detector has not triggered once, the real level of similarity is less than the threshold, therefore the detecting parameters are set incorrectly.
  2. If there are misoperations.  
Change the threshold level of similarity. For that, perform the following steps:
    - a) find the maximal value of all the similarity coefficients when the misoperations occurred;
    - b) find the minimal value of all the similarity coefficients when the true operations triggered;
    - c) as the threshold level of similarity, set the mean value between the maximal (a) and minimal (b) values found.The more the difference between values (a) and (b), the higher is the reliability of the jingle automatic detection.



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## Useful Links

<http://www.softlab-nsk.com/forward/docs.html>