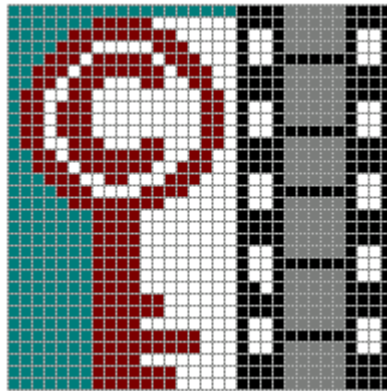


VIDEOMARK

Software Package for Digital Video
Copyright Protection

User's Manual

Version 1.5



Alpha Tec Ltd
www.alphatecltd.com
alphatec@alphatecltd.com

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Sales and distribution:

Alpha Tec Ltd
23 Papafi street
Thessaloniki 546 38
Greece

Tel, Fax: +30-2310-348019

Web:

www.alphatecltd.com

Email:

 alphatec@alphatecltd.com

 alphatec@otenet.gr

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1. General Description

1.1 Introduction

Videomark is software for casting and detecting invisible watermarks on digital video for copyright protection. Watermarks correspond to specific ID-numbers that are called watermark keys. Each copyright owner of digital video uses his/her private key to cast an invisible watermark. This watermark can be detected later by using the Videomark and the correct watermark key and without resorting to the original product.

Videomark is available in three versions:

- Full Version
- Demo Version
- SDK

Each copy of the full version is characterized by a unique ID number associated with a specific private key used for watermark casting.

1.2 Main Features

- Watermarks, inserted in an input video, are perceptually unnoticeable in the output video. Videomark supports five (5) embedding levels, which are associated to the strength of modifications performed for the watermark embedding.
- Generally, watermarks are detected with high certainty and extremely low false alarm probability. Independent detection is performed for each frame. Therefore, watermark detection can be used as a reliable evidence for proving copyright ownership.
- Watermarks cannot be extracted or removed without the knowledge of the corresponding private key. Watermark generation is image (frame) dependent and cryptographically secure.
- Watermarks are robust to MPEG2 encoding up to compression ratios 1:50 (5 Mbps compressed video).
- Video frame extraction or insertion does not affect seriously to the detection performance.
- Watermarking or detection can be applied to a full digital video sequence or a section of it.

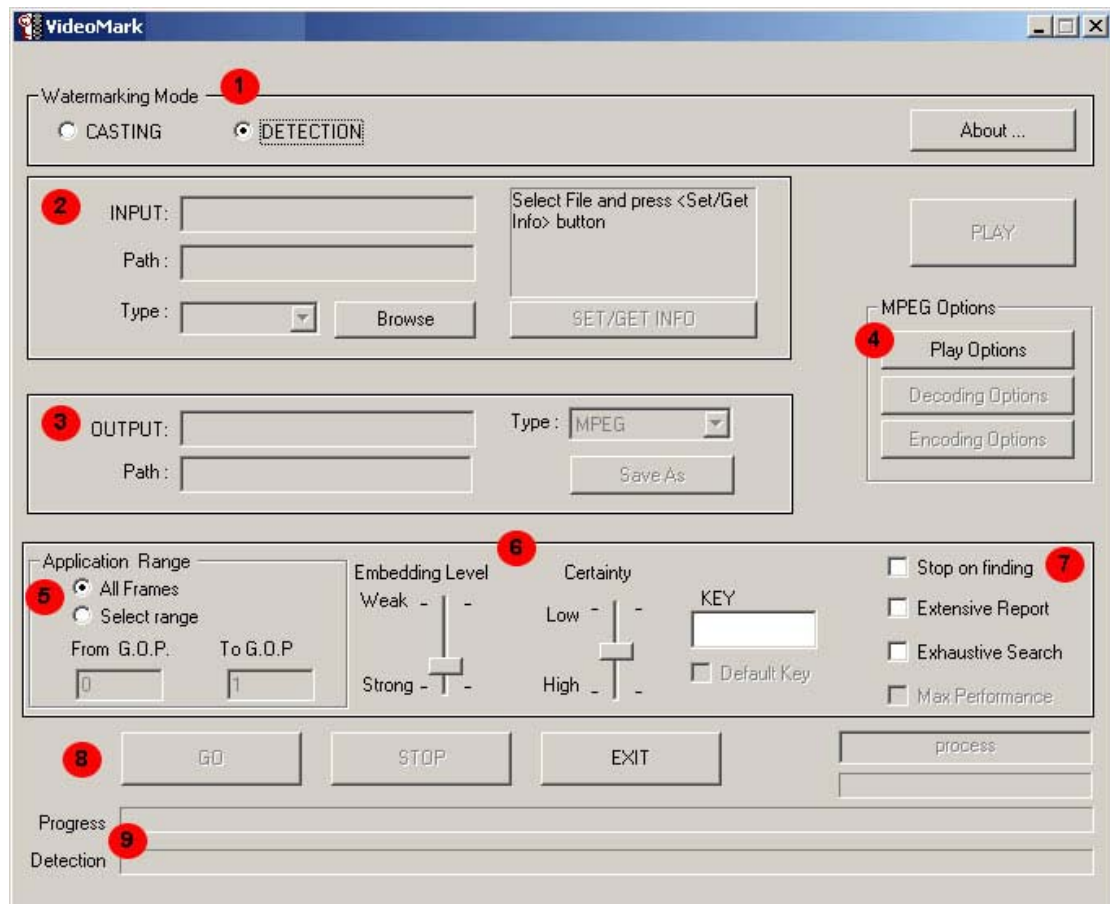


Figure 1: The Videomark's main program window

- (1) Watermarking mode panel
- (2) Input digital video panel
- (3) Output digital video panel
- (4) MPEG options panel
- (5) Application Range panel
- (6) and (7) Watermarking parameters panel
- (8) Watermarking procedure control buttons
- (9) Watermarking progress bar and watermark detection progress bar

1.3 Environment

Videomark is a “Dialog based application” created by using MFC classes of Visual C++. It supports the following digital video formats for both input and output:

- **YUV frames.** U,V or both frames may be subsampled or not. The Y frames should be named as < BasicFileNameXXX. Y > where XXX denotes the frame number.
- **MPEG 1, 2** video only or some formats of transport files. In the later case Audio is ignored. In this version only MPEG 2 MP@ML encoding is allowed.

An MPEG player has been also incorporated.

Progress Bars named “Progress” and “Detection” indicates the progress of the watermarking procedure, which is distinguished in two stages:

- Watermark CASTING
- Watermark DETECTION



Figure 2: Progress bars of Videomark's main window

1.4 System Requirements

Videomark's minimum system requirements are:

- Intel 486 processor or above
- Microsoft Windows 95/98/Me/NT/2000/XP/2003
- 64 MB of RAM installed (128 or above recommended)
- 20 MB of available hard-disk space
- 256-color display adapter card (24-bit display adapter card recommended)
- CD-ROM drive

2. User's Guide

2.1. Watermarking Mode

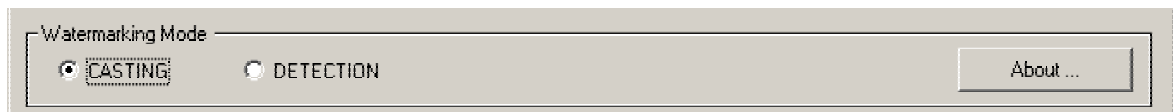


Figure 3 : Radio buttons for selecting operation mode

The watermarking *operation mode* is selected by the user by clicking the corresponding radio button at the top of the dialog. According to this selection some dialog features are disabled or enabled.

2.2. Input digital video sequence

In input digital video panel click browse. An Open File dialog window appears. Select the digital video file you want to watermark and click Open as shown in Figure 4.

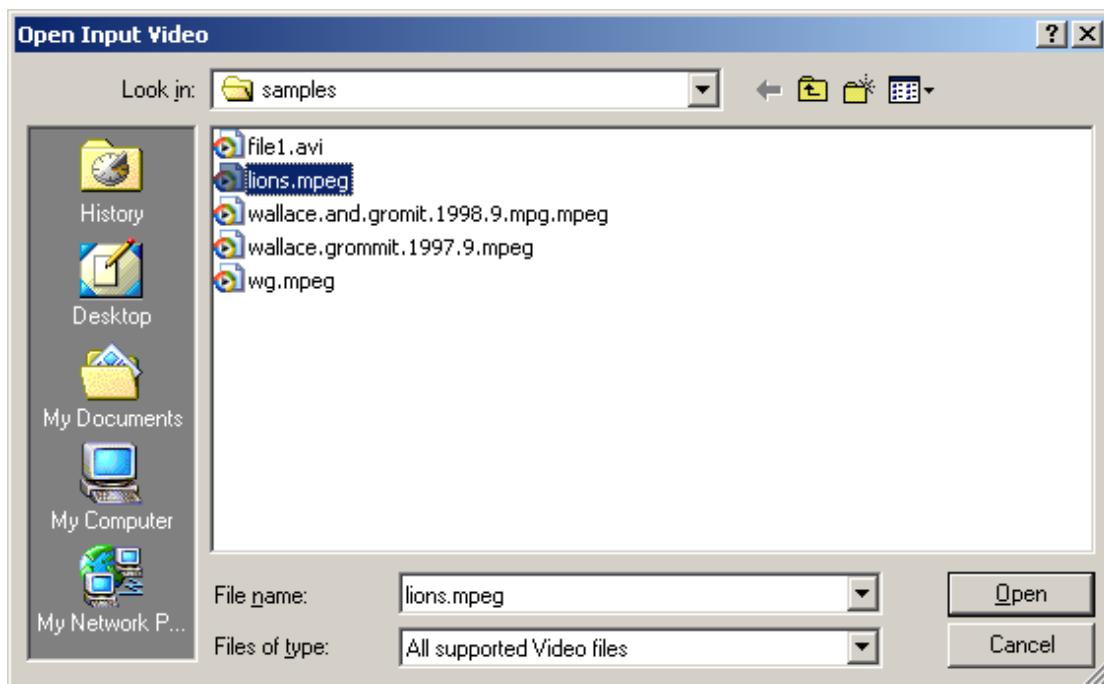


Figure 4 : The Open Input Video File dialog window

In the edit-boxes INPUT and Path, the filename and the location of the video should be inserted. The video format type is automatically selected as shown in Figure 5

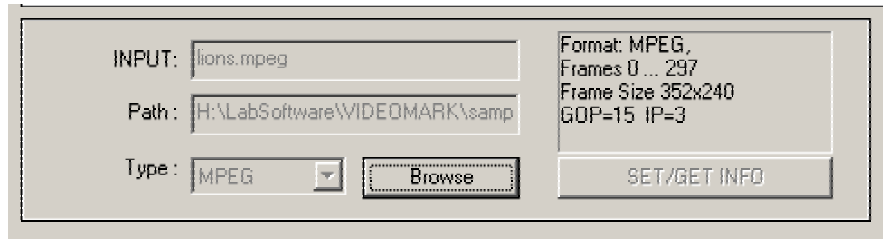


Figure 5 : Dialog region dealing with the input video which will be watermarked or searched for watermarks.

The input video is used either for watermark casting or detection according to the selected operation mode.

Information Area : Information about the video file is displayed. For MPEG format, this information is updated automatically from the corresponding file header when the file is selected by using the Browse button. If not the button SET/GET INFO should be clicked.

For MPEG formats the following information is displayed :

1. The number of frames (first and last index numbers)
2. The size of each frame in pixels (horizontal and vertical)
3. The size of a Group Of Pictures (GOP)
4. The distance between I and P frames

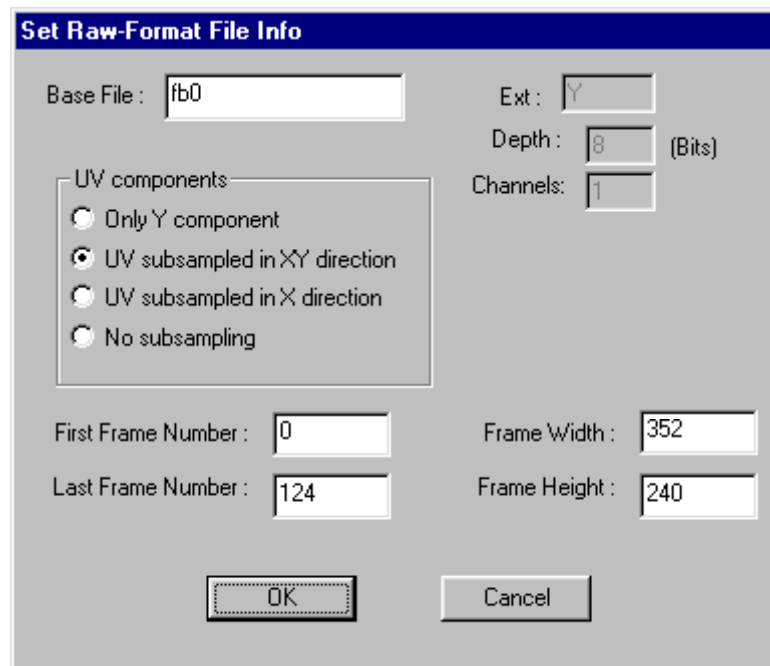
For YUV video type, information should be given by the user. By pressing the SET/GET INFO button the dialog presented in Figure 6 appears.

Base File : The basic part of the filenames of YUV frames is inserted (frame index numbers are not included).

First/Last Frame : The first and the last index of the frames in the video sequence.

Frame Width/height : The size of frames in pixels.

YUV Components : This option is used when MPEG encoding is used (for the casting procedure) and is related with the state of the Y,U, and V files. Watermark casting can be applied only to grayscale (Y) video sequence files and watermarked frames Y are output.




The dialog box titled "Set Raw-Format File Info" contains the following fields and options:

- Base File:
- Ext:
- Depth: (Bits)
- Channels:
- UV components section with radio buttons:
 - Only Y component
 - UV subsampled in XY direction
 - UV subsampled in X direction
 - No subsampling
- First Frame Number:
- Frame Width:
- Last Frame Number:
- Frame Height:
- Buttons: and

Figure 6: Dialog for inserting information about YUV frames

2.3 Output digital video



The output digital video panel includes the following elements:

- OUTPUT:
- Type: (dropdown menu)
- Path:
-

Figure 7: The output digital video panel

The filename of the produced watermarked video should be inserted in the *OUTPUT* edit-box. Extension of the filename should be defined by the user. The list *Type* denotes the format of the output file which is automatically detected by the program. To fill-up the “OUTPUT” and “Path” fields, press the **Save as** button. A dialog window appears. In the “File name” field type the name of the output digital video file and press the **Save** button as shown in Figure 8.

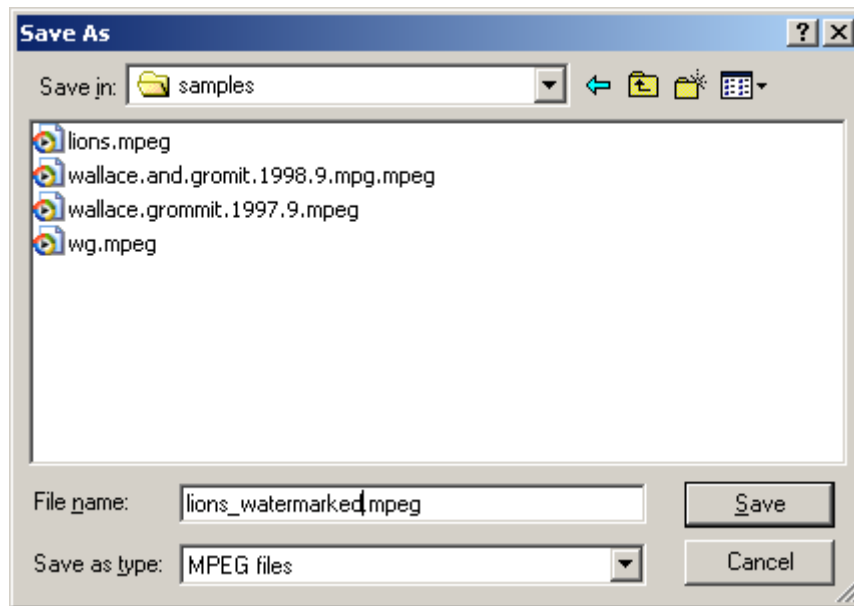


Figure 8: The “Save as” dialog window

2.4 Watermarking Parameters

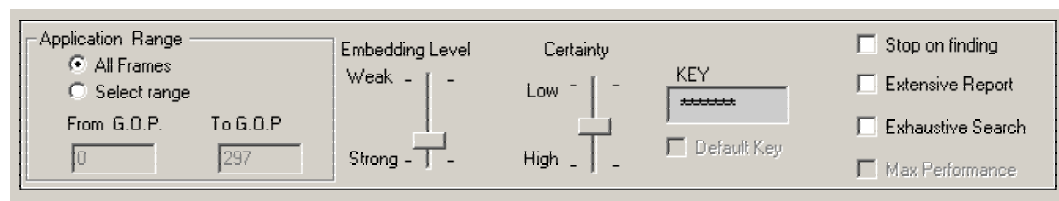


Figure 9 : Dialog area for watermarking control

Application Range : It defines the digital video section where on watermark casting or detecting will be applied. The selected area should consist of complete groups of pictures. The numbering of groups starts from 0.

Embedding Level : Five levels for the strength of modifications are available. Strong embedding produces greater image distortions but the watermark is sufficient robust to MPEG compression. Weak embedding produces invisible alterations.

Certainty: Watermark detection is assumed positive when the calculated certainty is greater than a threshold value (minimum certainty). Three such values are available.

Low Certanty=99.99%,
 Medium Certainty=99.9999% and
 High Certainty=99.999999%

Key : The private key (32-bit positive integer). For watermark casting only the private key is used.

Attention: For the DEMO VERSION, watermark casting can be applied by using 100 keys defined in a particular region (e.g. 1000000<key<1000100). Any key can be tested for watermark detection.

Stop on Finding : When it is checked, the detection procedure stops when watermark(s) are detected in a group of pictures (or in a set of 12 Y frames).

Extensive Report : After detection procedure, the *Videomark* produces a .txt file containing details about the detection. The false alarm detection probability for each frame is listed. The Notepad.exe is called and the information file is displayed.

Exhaustive Search : It is checked in order to perform detection synchronization, if it is lost. It should be used when detection is applied in a particular part of a video or when there is suspicion about frame insertion or extraction from the original video sequence.

Max Performance : It is enabled when *Exhaustive Search* is used. Detection proceeds to a detailed watermark search in cases of problems, e.g. loss of synchronization in the given range of frames.

2.4 Command Buttons



Figure 10: Watermarking procedure control buttons

GO : Starts the watermark casting or detection procedures

STOP : It is enabled when Casting or Detection is in progress. By pressing it, the background watermarking operations are broken up.

EXIT : Exit from *Videomark*.

2.5 MPEG – Player. Encoding -decoding Options

The player displays MPEG files. It plays a set of frames of either the input or output video. These options are defined in the corresponding dialog “**Play Options**” shown in Figure 11. Figure 12 shows the “Player Window”.

Warning : When video is playing only the message of the *Stop* button is processed. Closing the player’s window before proceeding to any other processing, is strongly recommended.

Decoding/Encoding Options have been incorporated for use in feature versions. At the present version, the user can choose the **bit-rate** of the MPEG encoder for the output video as shown in Figure 13.

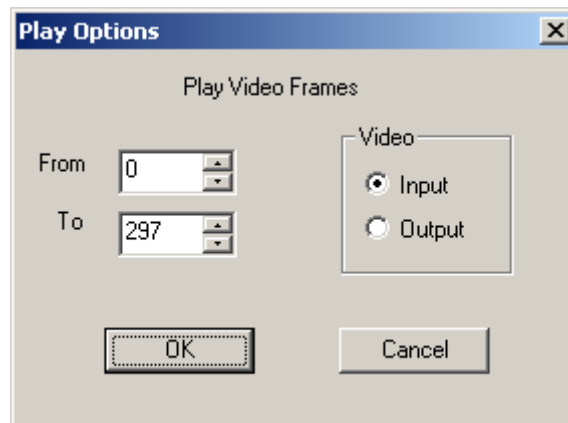


Figure 11: The Play Options Dialog window



Figure 12: The player window

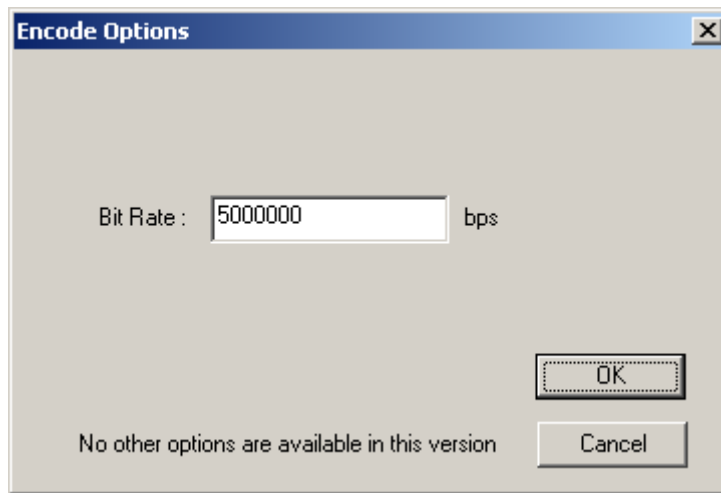


Figure 13: The Encode options dialog window

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