



Elecard XMuxer
Software Reference Design (SRD)
Reference Manual

Version 1.1

Notices

Elecard XMuxer Software Reference Design (SRD) Reference Manual

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1. Introduction

1.1 About This Document

1.1.1 Purpose

This document provides an overview of the installation, set up and use of the Elecard XMuxer SRD. It includes information about the structure of the Elecard XMuxer SRD, provides a quick overview of the DirectShow fundamentals and features a detailed description of the components and sample applications.

1.1.2 Topics Covered

The following lists the topics covered in this document:

- **Section 1: Introduction** – provides a general overview of the XMuxer SRD and describes the purpose of the document.
- **Section 2: Getting Started** – describes how to install, uninstall, and run the XMuxer Reference Design. This section also provides information on the XMuxer SRD folder structure.
- **Section 3: DirectShow Overview** – provides a brief description of the basic concepts of the DirectShow system, including component model, filters, graphs, and more.
- **Section 4: Sample Applications** – describes samples included in the Elecard XMuxer SRD.

1.1.3 Related Documentation

In order to thoroughly understand the DirectShow® technology, we strongly recommend that you read the following documentation:

- **Microsoft® DirectShow® Programmer Reference** described in Microsoft® DirectX Software Development Kit. You can find these documents at:
<http://www.microsoft.com/downloads>.

1.2 Preface

Elecard XMuxer SRD is a software reference design that allows programmers to develop audio/video editing applications (similar to Elecard XMuxer) or to extend any application functionality using the Elecard XMuxer Engine object. The SRD contains the source codes of sample applications. Each sample illustrates one of the Elecard XMuxer Engine work modes.

Elecard XMuxer Engine is a COM object that allows fast and lossless nonlinear editing. It supports all popular formats like MPEG-1 System Stream (SS), MPEG-2 Program Stream (PS) (including SVCD and DVD), MPEG-2 Transport Stream (TS), Sony AVCHD®, MP4 (Sony PSP, ISMA, iPod), ASF, WMV, AVI (DV, XviD, DivX, 3ivX), and some types of video and audio elementary streams (VES and AES). The Elecard SRD package includes the following:

1.2.1 Documentation

Elecard XMuxer SRD documentation consists of the following documents:

- Elecard XMuxer SRD Reference Manual (this document)
- Elecard Components Reference Manuals
- Elecard Base Classes Reference Manual
- Elecard Module Configuration Programmer Guide
- Elecard XMuxer SRD Release Notes

1.2.2 Components

This section provides a quick overview of the DirectShow filters and other components included in the XMuxer SRD package. For further details, see the Elecard Components Reference documentation.

Table 1. Elecard XMuxer SRD Components

Filters	Description	File Name
Elecard File List Source	DirectShow filter providing operations with a list of source files as with a single file. Implements the IAsyncReader interface on its output pin, allowing a connection to pull mode splitter filters such as Elecard MPEG Demultiplexer.	efls.ax
Elecard MPEG-2 Video Decoder	DirectShow filter for software-only real-time decoding of MPEG-2 (ISO/IEC 13818-2) and MPEG-1 (ISO/IEC 11172-2) video streams. Provides high resolution, full quality decoding, optimized for the most efficient CPU usage.	em2vd.ax
Elecard MPEG-4 Video Decoder	DirectShow filter for software-only decoding of MPEG-4 (ISO/IEC 14496-2) video streams.	em4vdec.ax
Elecard MPEG Audio Decoder	DirectShow filter for software-only decoding of MPEG-1, MPEG-2, MPEG-2.5 and LPCM audio streams.	elmad.ax
Elecard MPEG Demultiplexer	DirectShow filter for splitting of MPEG-1 System Streams (ISO/IEC 11172-1), MPEG-2 Program and Transport Streams (ISO/IEC 13818-1) into video and audio streams.	empgdmx.ax
Elecard LATM Demultiplexer	DirectShow filter that provides demultiplexing of AAC/LATM stream into elementary AAC stream.	elatmdmx.ax
Elecard Stream Parser	DirectShow filter for software-only splitting of audio streams (Dolby Digital, AAC etc.).	empgdmx.ax
Elecard MP4 Demultiplexer	DirectShow filter that provides demultiplexing of ISO/IEC 14496-14 file format (MP4) and 3GPP2 System streams into a MPEG-4, H.263, AVC/H.264 video streams and AAC, AMR, MPEG-1/2 Audio Layer 3 audio streams.	emp4demux.ax
Elecard MPEG Multiplexer	DirectShow filter that provides the MPEG-2 Transport Stream (TS) or MPEG-2 Program Stream (PS) generation.	empegmux.ax
Elecard MP4 Multiplexer	DirectShow filter intended for the generation of MPEG-4 (Intermedia Format (MP4)) System Streams.	emp4mux.ax
Elecard MPEG-2 Video Encoder	DirectShow filter for video encoding into MPEG-2 (ISO/IEC 13818-2).	em2venc.ax
SolveigMM ASF Multiplexer	DirectShow filter for the video and audio multiplexing into Microsoft Advanced Streaming Format. The filter is based on Microsoft Windows Media Format SDK. It allows processing of video and audio data in Windows Media and other formats (MPEG-4 AVC, DivX, XviD, MPEG-2 Video, AC3, MPEG- 1, 2 audio etc.).	smm_asfmuxer.ax
Elecard-SolveigMM MPEG2 Trimmer FA	DirectShow filter for MPEG-2 frame accuracy video trimming.	mp2trimmerfa.ax

Filters	Description	File Name
Elecard GOP Accuracy Trimmer	DirectShow filter for the trimming of MPEG-1 System Streams, MPEG-2 Program Streams and MPEG-2 Transport Streams. It is intended for team-work with the Elecard MPEG Demultiplexer filter.	egatrimmer.ax
Elecard XMuxer Engine	COM object that allows fast and lossless nonlinear editing. It supports all popular formats like MPEG-1 System Stream (SS), MPEG-2 Program Stream (PS) (including SVCD and DVD), MPEG-2 Transport Stream (TS), Sony AVCHD, MP4 (Sony PSP, ISMA, iPod), ASF, WMV, AVI (DV, XviD, DivX, 3ivX), and some types of video and audio elementary streams (VES and AES).	exmuxenginepro.dll
Elecard Sink Filter	DirectShow filter that dumps a stream to a file. It supports indexing of MPEG-2 VES and MPEG-2 PS and splitting the encoded file into parts of a predefined size.	esf.ax
Elecard DVD to DVB Subtitle Converter	DirectShow filter for the converting DVD to DVB subtitle.	eDVD2DVB.ax
Elecard Graph Viewer	Utility for the presentation of graphs built by any application. Elecard Graph Viewer allows the viewing and changing the filter properties, building of the filter graph (filter adding, deleting and connection), control of the graph state (run, stop and pause) and positioning in the media stream.	EIGViewer.dll

1.2.3 BaseClasses

BaseClasses – a C++ class library that simplifies commontasks, appearing during development of multimedia applications, such as: DirectShow graphs building, filters and pins control etc. Base classes are used in XMuxer SRD sample applications and are delivered in source form.

1.2.4 Sample Applications

Elecard XMuxer SRD samples are written in C++ using Elecard Base Classes. The following table provides a brief overview of each sample. For further details, see the Sample Applications section.

Table 2. Elecard XMuxer SRD Sample Applications

Sample Name	Description	File Name
Simple XMuxer	This sample application demonstrates remultiplexing of MPEG-1 System Streams, MPEG-2 Program and Transport Streams, MP4, AVI, ASF and WMV files using the Elecard XMuxer Engine COM object.	SimpleXMuxer.exe
Stream Extractor	This sample application demonstrates demultiplexing of MPEG-1 System Streams, MPEG-2 Program and Transport Streams, MP4, AVI, ASF and WMV files using the Elecard XMuxer Engine COM object.	StreamExtractor.exe
Files Merger	This sample application demonstrates merging of several uniform files into single file using the Elecard XMuxer Engine COM object.	FilesMerger.exe

1.3 System Requirements

The Elecard XMuxer SRD has the following hardware and software requirements:

- SSE-enhanced CPU (Intel® Pentium III, Celeron, AMD® Athlon, Opteron etc.)
- 128 MB RAM

- Any VGA card
- Windows® 2000/XP/2003 Server
- Microsoft® DirectX® Media SDK/Microsoft® DirectX® SDK (version 8.1 or later)

Note: Until April 2005, DirectShow was the part of DirectX. The last DirectShow patch for DirectX 9.0 is available in the DirectX 9.0 SDK Update (February 2005) Extras from <http://www.microsoft.com>. Then DirectShow was moved to the April 2005 Platform SDK. The DirectX SDK was, however, still required to build DirectShow samples. DirectShow was removed from the Platform SDK in 2006. Now Microsoft DirectShow 9.0 is available in the latest Windows SDK for Vista.

1.4 Technical Support

For technical support contact the Elecard Technical Support Team: tsup@elecard.com

2. Getting Started

2.1 Introduction

The following section details the procedures for the Elecard XMuxer SRD installing, uninstalling, filters activation and sample applications running.

2.2 Installing Elecard XMuxer SRD

To install the Elecard XMuxer SRD:

1. Run the Elecard XMuxer SRD setup. To run, double click the executable file from the Elecard XMuxer SRD setup package.
2. The *Elecard XMuxer SRD setup* window will appear. Read the recommendations and warnings. Click **Next**.
3. The Release Notes will appear. Click **Next**.
4. The license agreement will appear. Read the agreement and if you accept the terms within, select the “*Yes I agree with the terms of this license agreement*” check box. Click **Next**.
5. Select the destination folder in which you want to install the Elecard XMuxer SRD. Click **Next**.
6. Select the program group in which you want the Elecard XMuxer SRD to be located. Click **Next**.
7. To complete installation, follow the onscreen instructions. When setup has finished installing all of the necessary files on your computer, the appropriate message box with the text “Elecard XMuxer SRD has been successfully installed” will appear and the XMuxer SRD is ready to use.

2.2.1 Uninstalling Elecard XMuxer SRD

To uninstall the Elecard XMuxer SRD application:

1. Click *Start*→*Programs*→*Elecard*→*Elecard XMuxer SRD xx*→*Uninstall Elecard XMuxer SRD* (xx – the XMuxer SRD version number).

Follow the onscreen instructions to complete removal of the application.

2.3 Running the Elecard XMuxer SRD applications

To run the Elecard XMuxer SRD sample applications:

1. Click *Start*→*Programs*→*Elecard*→*Elecard XMuxer SRD xx*→*Bin* and select application (xx – the XMuxer SRD version number).

3. DirectShow Overview

3.1 Introduction

The following section provides an overview of the DirectShow components, including filter types and data flow graphs.

3.2 DirectShow main terms and definitions

At the heart of [DirectShow](#)[®] is a modular system of pluggable components called *Filters*. These filters are arranged in a configuration called a *Filter Graph*. The *Filter Graph Manager* component oversees the connection of these filters and controls the data flow stream. Applications that use DirectShow architecture control the activities of the Filter Graph by communicating with the Filter Graph Manager.

Most of the filters included in Microsoft[®] DirectShow[®] runtime reside in quartz.dll, while others are standalone .AX files. The DirectShow filters are DLL files. Many of them are installed to Windows\system directory and others are installed in the products specific catalogs.

The following is important to know about filter data streaming, connections, and pins:

- Data streams in packets (called *MediaSample*) from Source to Renderer through Transform filters.
- The connection from one filter to another is realized with the help of a *Pin*. A pin is an object that belongs to the filter. It provides a connection to other filter pins. The *Input Pin* receives a MediaSamples from upstream filter and the *Output Pin* sends the MediaSamples to downstream filter.
- The Source filter has at least one output pin, the Renderer filter has at least one input pin, and the Transform filter has both input and output pins.

3.2.1 DirectShow Filter Types

DirectShow filters have the following three main classes:

- **Source Filter** – provides the multimedia stream. It ranges from the File Source Filter to the MPEG encoding device source, or Network source.
- **Renderer Filter** – finishes a graph. The most common Renderer filters are Video Renderer and Audio Renderer, which play video and audio streams. A Renderer filter can also be a File Dump or File Writer filter and a Network Render filter.
- **Transform Filter** – the widest range of filters. All transformations on DirectShow[®] streams are made in transform filters. This type of filter is divided into Transform and TransInPlace filters. The TransInPlace filter differs from the Transform filter in memory allocation. It does not provide its own allocators, but uses ones from the upstream or downstream filter. It sends the same MediaSample that it received from the upstream to downstream filter and makes all data transformations in the MediaSample data buffer without changing its size.

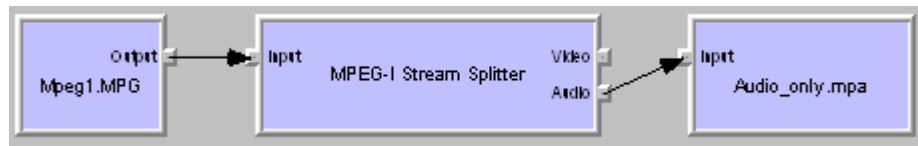
3.2.2 Data Flow Principle

The following describes the DirectShow data flow principle using the example of an audio stream being split from an MPEG stream and then dumped to a file.

For this task realization Filter Graph will be consist of 3 following filters:

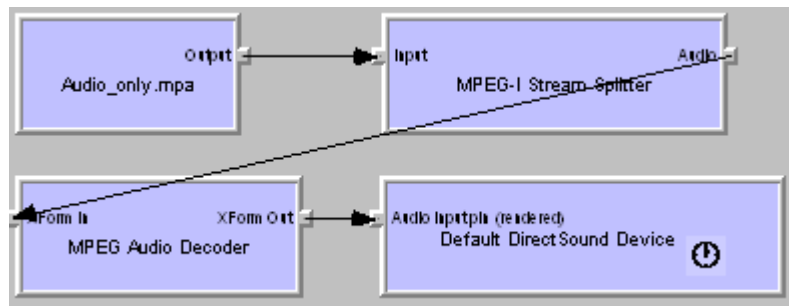
- **Async File Source** – gets data from the MPEG-1 file.
- **MPEG-1 Splitter** – splits MPEG-1 streams into MPEG-1 video and MPEG-1 audio elementary streams.
- **File Dump Filter** – writes compressed audio to the hard drive.

Figure 1. Audio Stream Splitting and Dumping to a File



Once the Audio file is split from the MPEG Stream and dumped into a file, it can easily be raised from the file, parsed, decoded and then played back by the following graph:

Figure 2. Dumped Audio File Playback Filter Graph



4. Sample Applications

4.1 Introduction

This section describes the sample applications included in the Elecard XMuxer SRD package. They are available from the XMuxer SRD program group (*Start→Programs→Elecard→Elecard XMuxer SRD→Samples*).

4.2 Elecard XMuxer SRD Sample Applications

The following section describes the XMuxer SRD Samples, including:

- Simple XMuxer
- Stream Extractor
- Files Merger

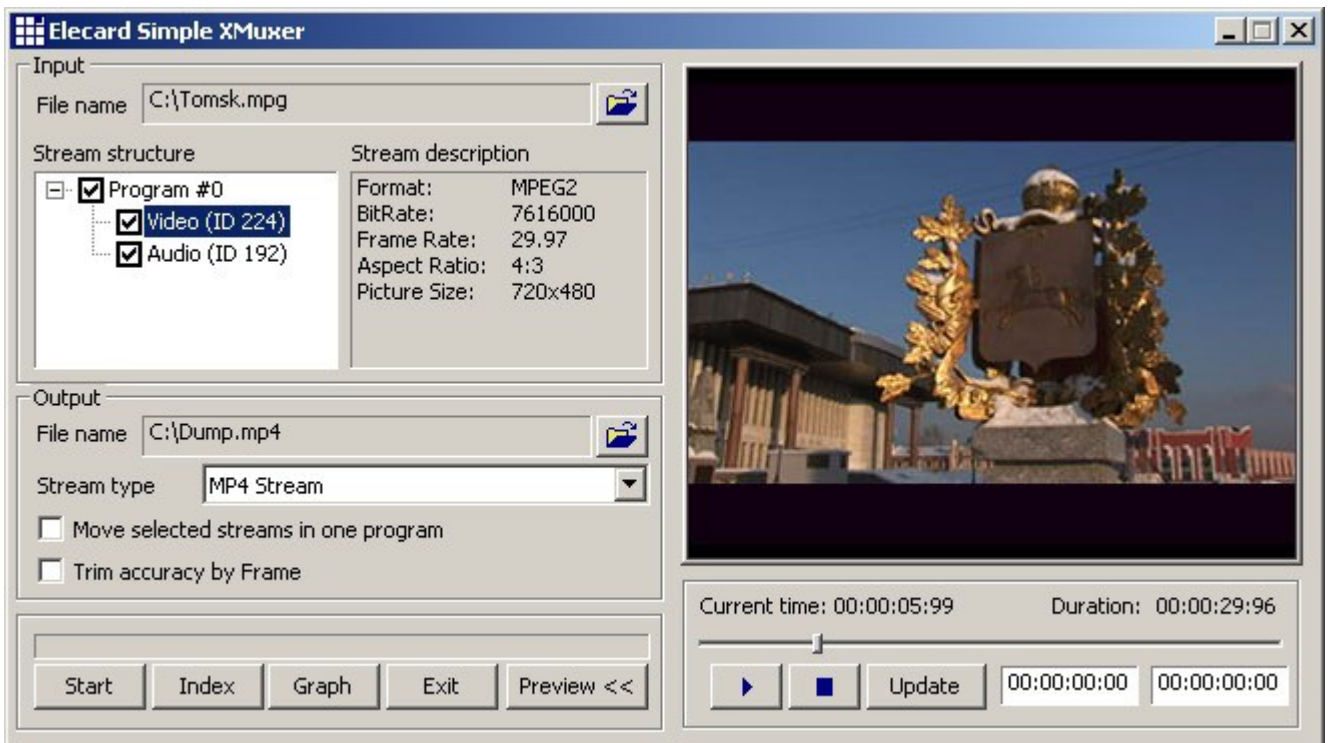
4.2.1 Simple Xmuxer

4.2.1.1 Description

Simple XMuxer is a sample application that demonstrates remultiplexing of MPEG-1 System Streams, MPEG-2 Program and Transport Streams, MP4, AVI, ASF and WMV files using the Elecard XMuxer Engine COM object.

The application allows user to preview video and audio content with the indexing possibility for accurate stream positioning, to multiplex video and audio elementary streams, to merge similar files, and provides multipart GOP-accurate trimming without re-encoding and quality loss, multipart frame-accurate MPEG-2 trimming and many other functions.

Figure 3. Simple XMuxer GUI



The Simple XMuxer sample application supports the following stream formats:

Input stream formats:

- MPEG-1 System Stream
- MPEG-2 Program Stream
- MPEG-2 Transport Stream
- MP4 file
- AVI file
- ASF file
- WMV file
- MPEG-1 video stream
- MPEG-2 video stream
- MPEG-4 video stream
- AVC/H.264 video stream
- MPEG-1 audio stream
- MPEG-2 audio stream
- MPEG-2.5 audio stream
- Dolby Digital audio stream
- AAC audio stream (with ADTS headers)
- AAC/LATM stream
- MPEG-1 Audio Layer (I, II, III) (ISO/IEC 11172-3)

- Linear PCM audio (an audio standard for DVD)
- etc.

Output stream formats:

- MPEG-2 Program Stream
- MPEG-2 Transport Stream
- MP4 file (including Sony PSP and iPod compatible files)
- AVI file
- ASF file

4.2.1.2 Path

Binaries (Elecard XMuxer SRD root)\Bin\SimpleXMuxer.exe

4.2.1.3 Features

Simple XMuxer implements the following features:

- Selected streams previewing
- Precise positioning using file indexation
- Loading of an index file created previously
- File list (.XPL files) support with ability to merge similar files
- Selected (marked) streams remultiplexing
- GOP-accurate MPEG-2, MPEG-4, AVC/H.264, VC-1 trimming
- GOP-accurate AVI (DV, [XviD](#), [DivX](#), 3ivX, etc), WMV, ASF trimming
- Frame-accurate MPEG-2 trimming
- Remultiplexing from one format to another: from MPEG-2 Program Stream to MPEG-2 Transport Stream, from MP4 to MPEG-2 Program Stream, from MP4 to AVI, etc.

4.2.1.4 Hot Keys

Table 3. Simple XMuxer Hot Keys

Hot Key	Description
CTRL+O	Opens media file.
CTRL+S	Selects file to save.
CTRL+F	Shows current filter graph.
F5	Starts/stops data processing.

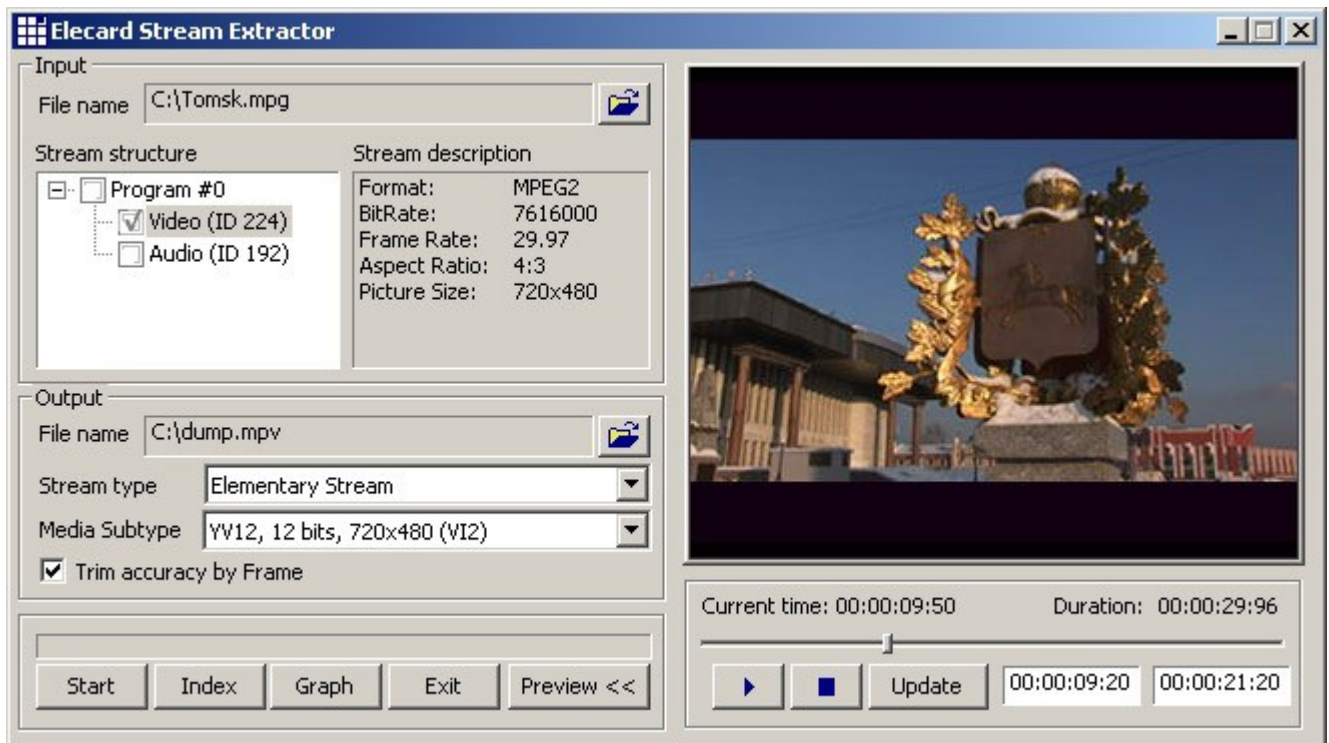
4.2.2 Stream Extractor

4.2.2.1 Description

Stream Extractor is a sample application that demonstrates demultiplexing of MPEG-1 System Streams, MPEG-2 Program and Transport Streams, MP4, AVI, ASF and WMV files using the Elecard XMuxer Engine COM object.

The application allows user to index media files for accurate positioning, provides multipart GOP-accurate trimming, multipart frame-accurate MPEG-2 video trimming and many other functions.

Figure 4. Stream Extractor GUI



The Stream Extractor sample application supports the following stream formats:

Input stream formats:

- MPEG-1 System Stream
- MPEG-2 Program Stream
- MPEG-2 Transport Stream
- MP4 file
- AVI file
- ASF file
- WMV file

Output stream formats:

- MPEG-1 video stream
- MPEG-2 video stream
- AVC/H.264 video stream
- MPEG-4 video stream
- MPEG-1 Audio Layer (I, II, III) (ISO/IEC 11172-3)
- MPEG-2.5 audio stream
- MPEG-2 audio stream
- Linear PCM (an audio standard for DVD)
- Dolby Digital audio stream
- AAC audio stream (with ADTS headers)

- etc.

4.2.2.2 Path

Binaries (Elecard XMuxer SRD root)\Bin\StreamExtractor.exe

4.2.2.3 Features

Stream Extractor implements the following features:

- Selected streams previewing
- Precise positioning using file indexation
- Loading of an index file created previously
- Selected (marked) streams demultiplexing
- Raw data support
- GOP-accurate MPEG-2, MPEG-4, AVC/H.264, VC-1 trimming
- GOP-accurate AVI (DV, XviD, DivX, 3ivX, etc), WMV, ASF trimming
- Frame-accurate MPEG-2 trimming

4.2.2.4 Hot Keys

Table 4. Simple XMuxer Hot Keys

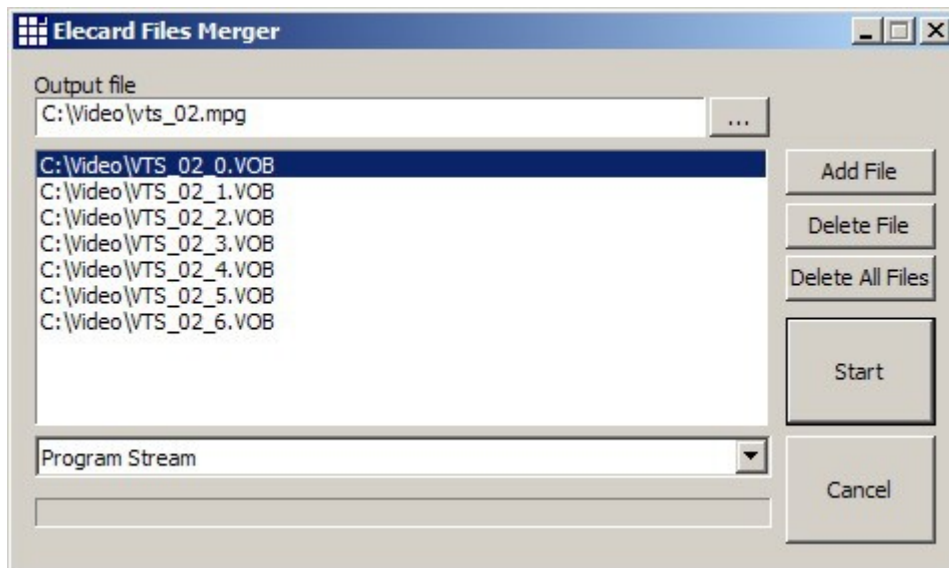
Hot Key	Description
CTRL+O	Opens media file.
CTRL+S	Selects file to save.
CTRL+F	Shows current filter graph.
F5	Starts/stops data processing.

4.2.3 Files Merger

4.2.3.1 Description

Files Merger is a sample application that demonstrates merging of several uniform files into single file using the Elecard XMuxer Engine COM object. The application allows creation and editing of the file list for merging, specifying of the output file name and type. The added or inserted files should be of the same resolution, profile and level, multiplexing type (i.e. either program stream only, transport stream only, or systems stream only), and should have the same PIDs or stream IDs, as the files already contained in the file list.

Figure 5. Files Merger GUI



The Files Merger sample application supports the following stream formats:

Input stream formats:

- MPEG-1 System Stream
- MPEG-2 Program Stream
- MPEG-2 Transport Stream
- Sony AVCHD®

Output stream formats:

- MPEG-2 Program Stream
- MPEG-2 Transport Stream
- ASF file

4.2.3.2 Path

Binaries (Elecard XMuxer SRD root)\Bin\FilesMerger.exe

4.2.3.3 Features

Files Merger implements the following features:

- Merging of several uniform files into single file

4.2.3.4 Hot Keys

Table 5. Files Merger Hot Keys

Hot Key	Description
CTRL+O	Opens media file(s).
CTRL+S	Selects file to save.
DELETE	Delete selected file from list.
F5	Starts/stops files merging.