NEC

Application Note

CvADPCM

Voice Data Conversion Tool

Target devices

78K0 Microcontrollers
78K0R Microcontrollers
V850E Microcontrollers
V850ES Microcontrollers

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[MEMO]

NOTES FOR CMOS DEVICES

① VOLTAGE APPLICATION WAVEFORM AT INPUT PIN

Waveform distortion due to input noise or a reflected wave may cause malfunction. If the input of the CMOS device stays in the area between V_{IL} (MAX) and V_{IH} (MIN) due to noise, etc., the device may malfunction. Take care to prevent chattering noise from entering the device when the input level is fixed, and also in the transition period when the input level passes through the area between V_{IL} (MAX) and V_{IH} (MIN).

② HANDLING OF UNUSED INPUT PINS

Unconnected CMOS device inputs can be cause of malfunction. If an input pin is unconnected, it is possible that an internal input level may be generated due to noise, etc., causing malfunction. CMOS devices behave differently than Bipolar or NMOS devices. Input levels of CMOS devices must be fixed high or low by using pull-up or pull-down circuitry. Each unused pin should be connected to V_{DD} or GND via a resistor if there is a possibility that it will be an output pin. All handling related to unused pins must be judged separately for each device and according to related specifications governing the device.

③ PRECAUTION AGAINST ESD

A strong electric field, when exposed to a MOS device, can cause destruction of the gate oxide and ultimately degrade the device operation. Steps must be taken to stop generation of static electricity as much as possible, and quickly dissipate it when it has occurred. Environmental control must be adequate. When it is dry, a humidifier should be used. It is recommended to avoid using insulators that easily build up static electricity. Semiconductor devices must be stored and transported in an anti-static container, static shielding bag or conductive material. All test and measurement tools including work benches and floors should be grounded. The operator should be grounded using a wrist strap. Semiconductor devices must not be touched with bare hands. Similar precautions need to be taken for PW boards with mounted semiconductor devices.

④ STATUS BEFORE INITIALIZATION

Power-on does not necessarily define the initial status of a MOS device. Immediately after the power source is turned ON, devices with reset functions have not yet been initialized. Hence, power-on does not guarantee output pin levels, I/O settings or contents of registers. A device is not initialized until the reset signal is received. A reset operation must be executed immediately after power-on for devices with reset functions.

⑤ POWER ON/OFF SEQUENCE

In the case of a device that uses different power supplies for the internal operation and external interface, as a rule, switch on the external power supply after switching on the internal power supply. When switching the power supply off, as a rule, switch off the external power supply and then the internal power supply. Use of the reverse power on/off sequences may result in the application of an overvoltage to the internal elements of the device, causing malfunction and degradation of internal elements due to the passage of an abnormal current.

The correct power on/off sequence must be judged separately for each device and according to related specifications governing the device.

⑥ INPUT OF SIGNAL DURING POWER OFF STATE

Do not input signals or an I/O pull-up power supply while the device is not powered. The current injection that results from input of such a signal or I/O pull-up power supply may cause malfunction and the abnormal current that passes in the device at this time may cause degradation of internal elements.

Input of signals during the power off state must be judged separately for each device and according to related specifications governing the device.

PREFACE

Readers

This manual is intended for users who wish to design and develop application systems using the 78K0, 78K0R, V850E, or V850ES microcontroller.

Purpose

This manual is intended to give users an understanding of the functions of CvADPCM that supports application and development of the 78K0, 78K0R, V850E, and V850ES microcontrollers.

Organization

This manual consists of the following contents.

- Overview
- Installation
- Operations

How to Read This Manual

It is assumed that the readers of this manual have general knowledge in the fields of electrical engineering, logic circuits, microcontrollers, and C.

To gain a general understanding of functions:

→Read this manual in the order of the **CONTENTS**. The mark "<R>" shows major revised points. The revised points can be easily searched by copying an "<R>" in the PDF file and specifying it in the "Find what:" field.

To understand details of the hardware functions

→Refer to the hardware user's manual of each product.

To understand details of the instruction functions

- With the 78K0 or 78K0R microcontroller
  →Refer to the instruction user's manual of each product.
- With the V850E or V850ES microcontroller
  →Refer to the architecture user's manual of each product.

To understand details of a conversion function

→Refer to the **ADPCM-SP Voice Compression/Expansion Software Package User's Manual** and **ADPCM-SP2 Voice Expansion Software Package User's Manual**.

Conventions

Data significance:	Higher digits on the left and lower digits on the right
Active low representation:	$\overline{xxx}$ (overscore over pin or signal name)
Memory map address:	Higher addresses on the top and lower addresses on the bottom
Note:	Footnote for item marked with **Note** in the text
Caution:	Information requiring particular attention
Remark:	Supplementary information
Numeric representation:	Binary ... xxxx or xxxxB
	Decimal ... xxxx
	Hexadecimal ... xxxxH

Prefix indicating power of 2 (address space, memory capacity):

K (kilo):	$2^{10} = 1,024$
M (mega):	$2^{20} = 1,024^2$
G (giga):	$2^{30} = 1,024^3$

Related Documents The related documents indicated in this publication may include preliminary versions. However, preliminary versions are not marked as such.

Documents Related to Voice Conversion Tools

Document Name	Document No.
ADPCM-SP Voice Compression/Expansion Software Package User's Manual	U18869E
ADPCM-SP2 Voice Expansion Software Package User's Manual	U19013E
CvADPCM Voice Data Conversion Tool Application Note	This manual

Documents Related to 78K0 Microcontroller Devices

Document Name	Document No.
78K0/KB2 User's Manual	U17328E
78K0/KC2 User's Manual	U17336E
78K0/KD2 User's Manual	U17312E
78K0/KE2 User's Manual	U17260E
78K0/KF2 User's Manual	U17397E
78K/0 Series Instruction User's Manual	U12326E
78K0/Kx2 Flash Memory Programming (Programmer) Application Note	U17739E
78K0/Kx2 Flash Memory Self Programming User's Manual[Note]	U17516E
78K0/Kx2 EEPROM™ Emulation Application Note[Note]	U17517E

Note Contact an NEC Electronics sales representative or distributor.

Documents Related to 78K0 Microcontroller Development Tools (Software) (User's Manuals)

Document Name		Document No.
RA78K0 Ver. 3.80 Assembler Package	Operation	U17199E
	Language	U17198E
	Structured Assembly Language	U17197E
CC78K0 Ver. 3.70 C compiler	Operation	U17201E
	Language	U17200E
SM+ System Simulator	Operation	U17246E
	User Open Interface	U17247E
ID78K0-QB Ver. 2.90 Integrated Debugger	Operation	U17437E
PM+ Ver. 6.00		U18416E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document when designing.

Documents Related to 78K0R Microcontroller Devices

Document Name	Document No.
78K0R/KE3 User's Manual	U17854E
78K0R/KF3 User's Manual	U17893E
78K0R/KG3 User's Manual	U17894E
78K0R/KJ3 User's Manual	U18417E
78K0R/KH3 User's Manual	U18432E
78K0R Microcontroller Instruction User's Manual	U17792E

Documents Related to 78K0R Microcontroller Development Tools (Software) (User's Manuals)

Document Name		Document No.
CC78K0R Ver. 1.00 C compiler	Operation	U17838E
	Language	U17837E
RA78K0R Ver. 1.00 Assembler Package	Operation	U17836E
	Language	U17835E
SM+ System Simulator	Operation	U18601E
PM+ Ver. 6.30		U18416E
ID78K0R-QB Ver. 3.20 Integrated Debugger	Operation	U17839E

Documents Related to 78K0/78K0R Microcontroller Development Tools (Hardware) (User's Manuals)

Document Name	Document No.
QB-78K0KX2 In-Circuit Emulator[Note 1]	U17341E
QB-78K0MINI On-Chip Debug Emulator[Note 1]	U17029E
QB-78K0RKX3 In-Circuit Emulator[Note 2]	U17866E
QB-MINI2 On-Chip Debug Emulator with Programming Function	U18371E

Notes 1. 78K0 microcontrollers only

2. 78K0R microcontrollers only

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document when designing.

Documents Related to V850E Microcontroller Devices

Document Name	Document No.
V850E/MA1 Hardware User's Manual	U14359E
V850E/IA1 Hardware User's Manual	U14492E
V850E/MA2 Hardware User's Manual	U14980E
V850E/IA2 Hardware User's Manual	U15195E
V850E/ME2 Hardware User's Manual	U16031E
V850E/SV2 Hardware User's Manual	U16384E
V850E/MA3 Hardware User's Manual	U16397E
V850E/IA3, V850E/IA4 Hardware User's Manual	U16543E
V850E/IF3, V850E/IG3 Hardware User's Manual	U18279E
V850E1 Architecture User's Manual	U14559E

Documents Related to V850ES Microcontroller Devices

Document Name	Document No.
V850ES/SA2, V850ES/SA3 Hardware User's Manual	U15905E
V850ES/PM1 Hardware User's Manual	U16237E
V850ES/IK1 Hardware User's Manual	U16910E
V850ES/KJ2 Hardware User's Manual	U17702E
V850ES/KG2 Hardware User's Manual	U17703E
V850ES/KF2 Hardware User's Manual	U17704E
V850ES/KE2 Hardware User's Manual	U17705E
V850ES/JJ2 Hardware User's Manual	U17714E
V850ES/JG2 Hardware User's Manual	U17715E
V850ES/IE2 Hardware User's Manual	U17716E
V850ES/HJ2 Hardware User's Manual	U17717E
V850ES/HG2 Hardware User's Manual	U17718E
V850ES/HF2 Hardware User's Manual	U17719E
V850ES/HE2 Hardware User's Manual	U17720E
V850ES/SG3 Hardware User's Manual	U17728E
V850ES/SJ3 Hardware User's Manual	U17790E
V850ES/JJ3 Hardware User's Manual	U18376E
V850ES/JG3 Hardware User's Manual	U18708E
V850ES Architecture User's Manual	U15943E

Caution The related documents listed above are subject to change without notice. Be sure to use the latest version of each document when designing.

Documents Related to V850E/V850ES Microcontroller Development Tools (User's Manuals)

Document Name		Document No.
CA850 Ver. 3.20 C Compiler Package	Operation	U18512E
	C Language	U18513E
	Assembly Language	U18514E
	Link Directive	U18515E
PM+ Ver. 6.30 Project Manager		U18416E
ID850QB Ver. 3.40 Integrated Debugger	Operation	U18604E
SM+ System Simulator	Operation	U18601E
PM+ Ver. 6.20		U18416E
RX850 Ver. 3.20 Real-Time OS	Basics	U13430E
	Installation	U17419E
	Technical	U13431E
	Task Debugger	U17420E
RX850 Pro Ver. 3.20 Real-Time OS	Basics	U13773E
	Installation	U17421E
	Task Debugger	U17422E
AZ850 Ver. 3.30 System Performance Analyzer		U17423E

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CONTENTS

CHAPTER 1 OVERVIEW

CvADPCM is a tool that generates ADPCM data to implement a voice application for the V850, 78K0R, and 78K0 microcontrollers. Running on Windows™, this tool converts WAV files (PCM) into ADPCM (40 kbps to 16 kbps). The result of conversion is output as a source code that can be read by the PM+ of the V850, 78K0R, or 78K0 microcontrollers. In addition, it can also transfer data directly to a sound board, such as TK-78K0R/KG3+Voice, connected to the COM port of a PC (possible only if the board supports this function).

ADPCM stands for adaptive differential PCM, and it supports the following algorithms.

- CCITT Recommendation G.726 (40 kbps, 32 kbps, 24 kbps, 16 kbps)
- NEC Electronics' ADPCM-SP (32 kbps, 24 kbps, 16 kbps)
- NEC Electronics' ADPCM-SP2 (32 kbps, 16 kbps)

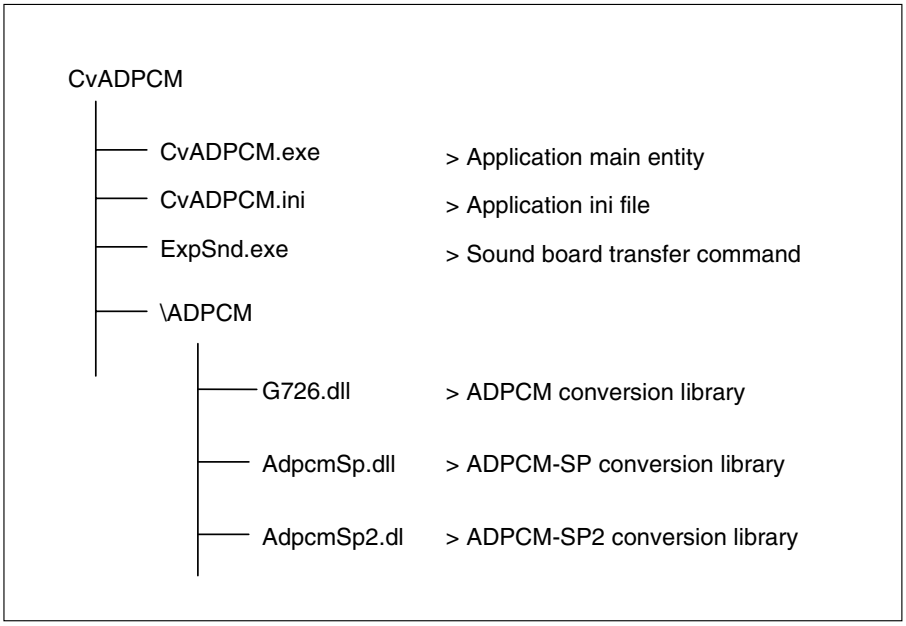
<R> **Remark** TK-78K0R/KG3+Voice is a product of TESSERA TECHNOLOGY INC..
Phone: 81-44 271-7533 TESSERA TECHNOLOGY INC.

CHAPTER 2 OPERATION ENVIRONMENT

CvADPCM can be used on a PC on which Windows XP™ or Windows Vista™ correctly runs. This tool may not run on Windows 2000 because it uses the functions of DirectX.

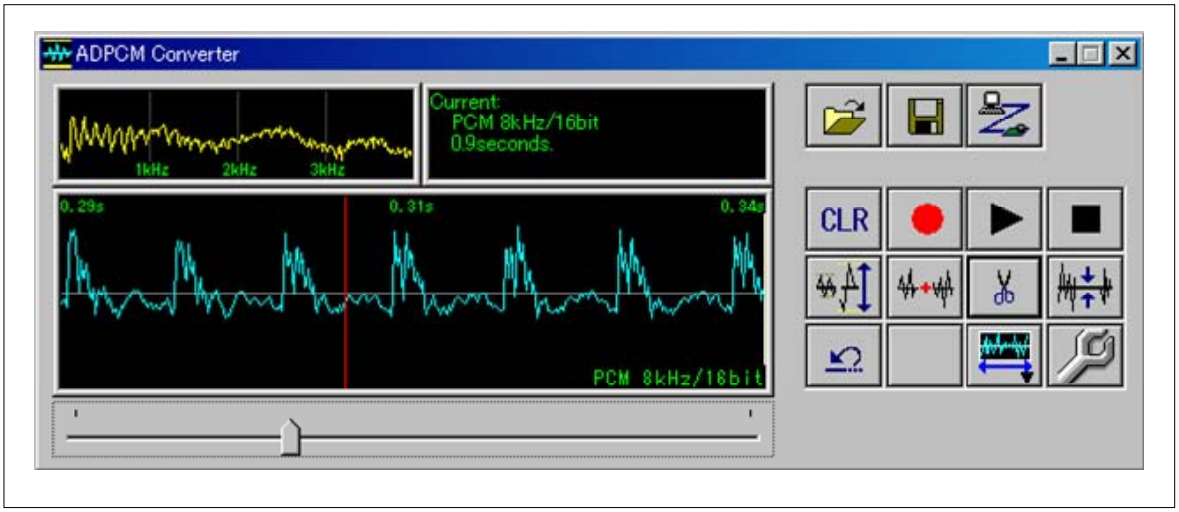
Extract and expand CvADPCM.zip in any folder.

Example: Files expanded to CvADPCM folder



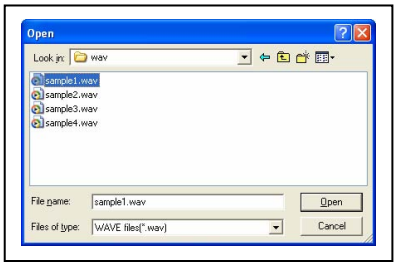
CHAPTER 4 OPERATIONS

4.1 Main Window



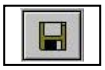
<1> Open WAV file icon

Opens a WAV file.

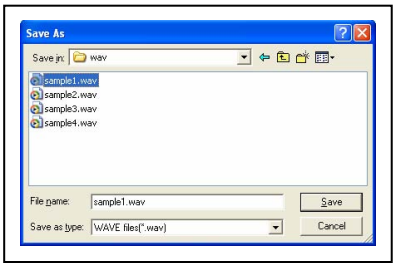


When this icon is clicked, the Open dialog box is displayed and any WAV file can be opened.

<2> Save WAV (PCM 8 kHz/16 bits) file icon



Saves a WAV file.



When this icon is clicked, the Save As dialog box is displayed and a WAV file can be saved.

CvADPCM converts read data, through 8 kHz sampling and 16-bit quantization, and saves the result of conversion to a file.

<3> Export data icon

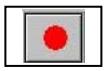
This icon is used to convert a file currently being read.

For details of exporting data, refer to **4.2 Export Dialog Box**.

<4> Clear data icon

This icon is used to clear the data currently being read.

<5> Record icon

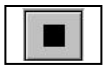


This icon is used to record voice.
If recording is carried out while another WAV file is read, the recorded WAV file is added after the already read WAV file.

<6> Playback icon

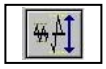
This icon is used to playback the data currently read.

<7> Stop recording or playback icon

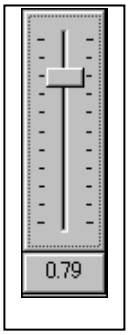


This icon is used to stop recording or playback.

<8> Volume control icon

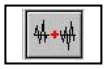


This icon is used to turn up or down the volume of the WAV file currently read.

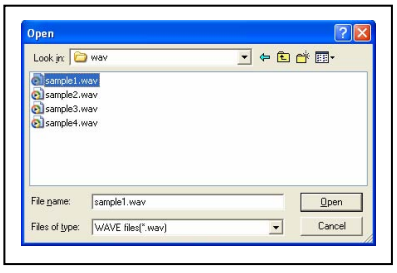


When this icon is clicked, the volume control knob shown here is displayed, so that the volume can be adjusted by sliding the adjuster bar.

<9> Merge WAV files icon



This icon is used to read a new WAV file and merge it with a WAV file that has already been read.

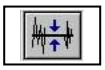


The newly read data is converted into 8 kHz, 16-bit data, and merged after already read data.

<10> Delete selected part icon

This icon is used to delete voice data in a selected range.
It deletes voice data in a range specified by using the mouse on the waveform view window. For the waveform view window, see <17> Waveform view window.

<11> Mute selected part icon

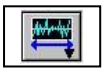


This icon is used to mute a selected range.
It mutes a range specified by using the mouse on the waveform view window. For the waveform view window, see <17> Waveform view window.

<12> Undo icon

This icon is used to restore the previous operation.

<13> Change waveform view width icon



This icon is used to change the display scale on the waveform view window.
Five display scales are selectable: 0.05 s, 0.1 s, 0.2 s, 0.5 s, and 1.0 s.
For the waveform view window, see <17> Waveform view window.

<14> Settings icon

This icon is used to open the Settings dialog box for configuring settings.
For details of the Settings dialog box, refer to **4.3 Settings Dialog Box**.

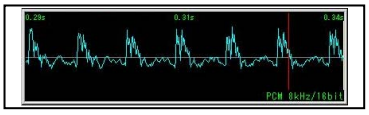
<15> Frequency view window

This window displays the spectrum at the cursor position on the waveform view window.

<16> File information window

This window displays information on the WAV file currently opened.
It displays a file name, sampling rate/quantization size, and playback time.

<17> Waveform view window



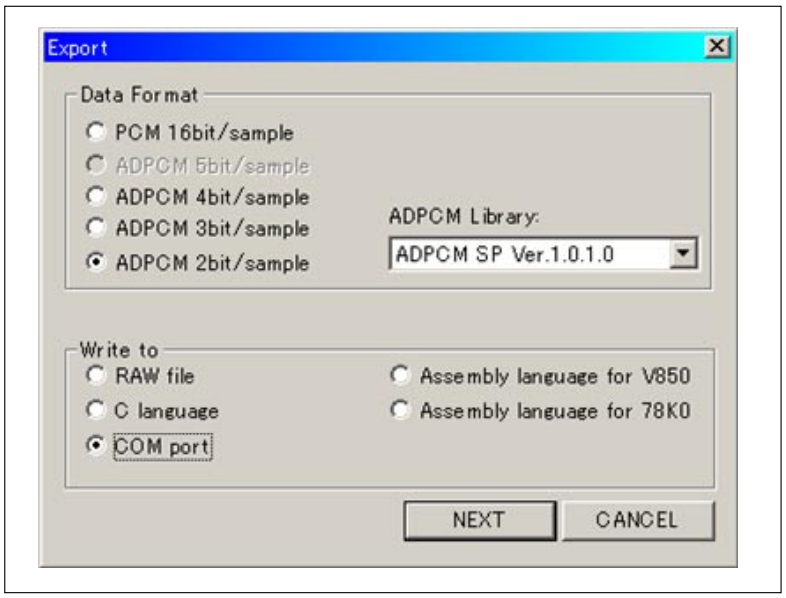
This window displays the waveform of the WAV file currently opened.

<18> View zone slide bar

The data zone to be displayed on the waveform view window can be changed by using this slide bar.

4.2 Export Dialog Box

The Export dialog box shown below is displayed when the Export data icon is clicked.



This dialog box is used to output the current voice data to an external device.

<1> Data Format

Selects a conversion format.

- PCM 16bit/sample

  Outputs data in the linear PCM (16 bits/sample) format.
- ADPCM 5bit/sample

  Outputs data in the ADPCM (5 bits/sample) format.

  This can be selected only when ADPCM G.726 is selected in the ADPCM Library drop-down list box.
- ADPCM 4bit/sample

  Outputs data in the ADPCM (4 bits/sample) format.
- ADPCM 3bit/sample

  Outputs data in the ADPCM (3 bits/sample) format.
- ADPCM 2bit/sample

  Outputs data in the ADPCM (2 bits/sample) format.

<2> ADPCM Library:

Selects an ADPCM library for conversion.

By default, the following three types of libraries are selectable.

ADPCM SP Ver.1.0.1.0	ADPCM of NEC Electronics Select this library or ADPCM SP2 when TK-78K0R/KG3+Voice is used. For details, refer to the **ADPCM-SP Voice Compression/Expansion Software Package User's Manual**.
ADPCM SP2 Ver.1.0.1.0	ADPCM of NEC Electronics Select this library or ADPCM SP when TK-78K0R/KG3+Voice is used. For details, refer to the **ADPCM-SP2 Voice Expansion Software Package User's Manual**.
ADPCM G.726 Ver.0.1.0.0	ADPCM conforming to CCITT recommendation G.726. Note that the TK-78K0R/KG3+Voice does not support this library.

<3> Write to

Selects a destination to which the result of conversion is to be output.

- RAW file
  Generates a binary file.
- C language
  Generates a file in the C source file format.
- COM port
  Transfers data with an external device, such as TK-78K0R/KG3+Voice, serially through RS-232C (or USB).
  Sets a COM port number in advance in the Export settings tab on the Settings dialog box. For serial output, refer to **4.4 Serial Transfer**.
- Assembly language for V850
  Generates a file in the assembler file format for the V850 microcontrollers.
- Assembly language for 78K0
  Generates a file in the assembler file format for the 78K microcontrollers.

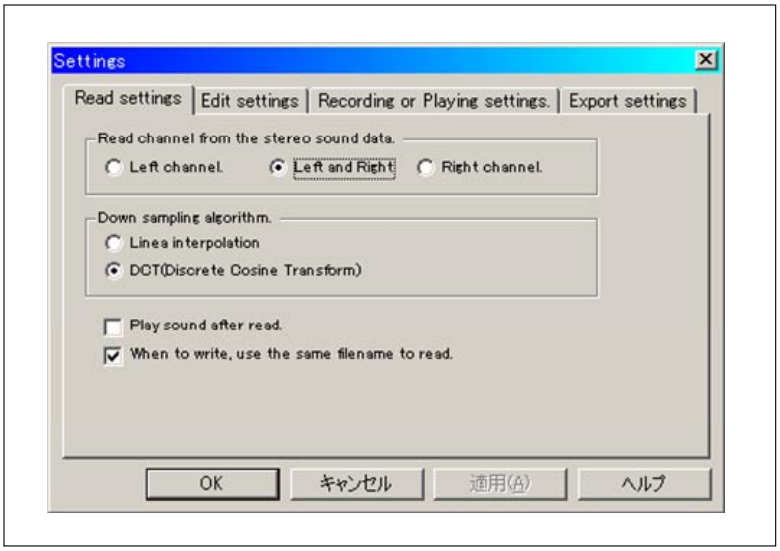
After selecting the necessary items, click NEXT. The output processing will be started if a COM port is selected as the output destination. If a file is selected, a dialog box for specifying a file name is displayed. Enter a file name and click Save to output the data to the specified file.

<R> **Remark** TK-78K0R/KG3+Voice is a product of TESSERA TECHNOLOGY INC..
Phone: 81-44 271-7533 TESSERA TECHNOLOGY INC.

4.3 Settings Dialog Box

The Settings dialog box is displayed when the Settings icon is clicked.

4.3.1 Read settings tab



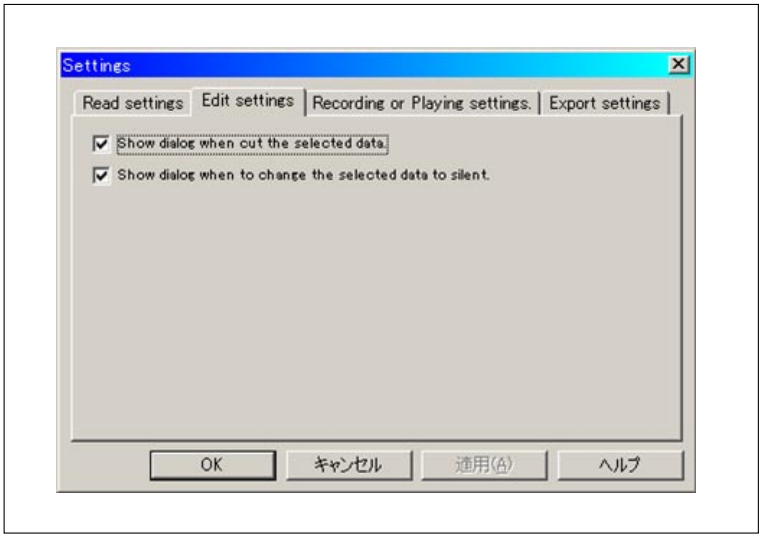
<1> Read channel from the stereo sound data
Selects left channel, right channel, or both.

<2> Down sampling algorithm
Specifies a mode to convert into 8 kHz the voice data that has been read if the data exceeds 8 kHz (data of less than 8 kHz is not processed). If the Linear interpolation option button is selected, the data can be converted at high speeds, but the sound quality of some voices may degrade because noise is superimposed. If the DCT (Discrete Cosine Transform) option button is selected, the sound quality barely degrades but it takes time for data conversion.

<3> Play sound after read
When this check box is selected, the voice data is played back once immediately after its WAV file has been read.

<4> When to write, use the same filename to read
When this check box is selected, the name of the read file is displayed on the Save As dialog box that is displayed when the Save WAV (PCM 8 kHz/16 bits) file icon is clicked. Because CvADPCM converts the format of data through 8 kHz sampling and 16-bit quantization, the file can be protected from being overwritten by clearing this check box. If a file is repeatedly edited and saved, select this check box so that the file does not have to be specified each time it is edited or saved.

4.3.2 Edit settings tab

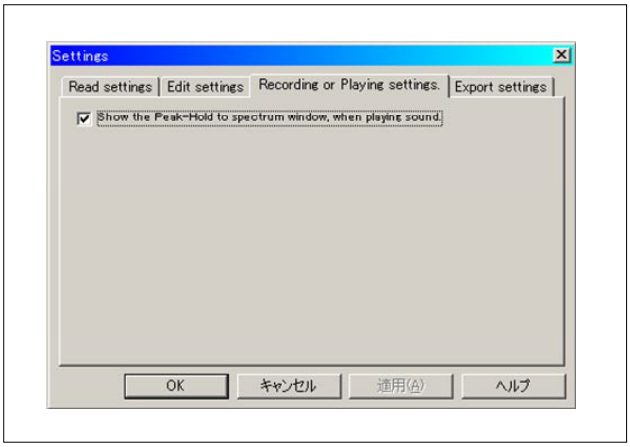


When deleting or muting a specified range, whether to display a confirmation dialog box upon clicking of the corresponding icon can be selected in the Edit settings tab.

<1> Show dialog when cut the selected data
When this check box is selected, a confirmation dialog box is displayed if the Delete selected part icon is clicked.

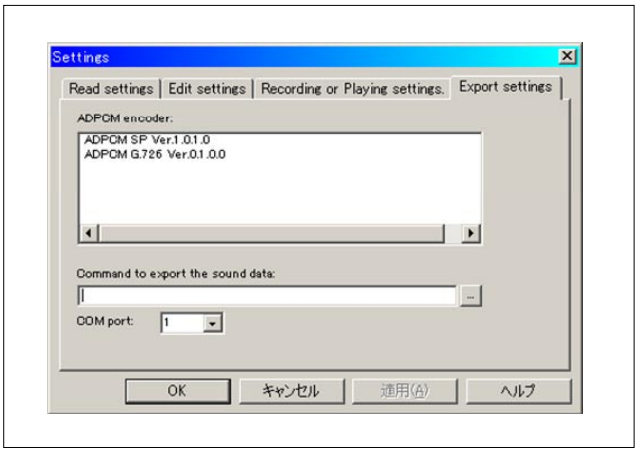
<2> Show dialog when to change the selected data to silent
When this check box is selected, a confirmation dialog box is displayed if the Mute selected part icon is clicked.

4.3.3 Recording or Playing settings tab



<1> Show the Peak-Hold to spectrum window, when playing sound
When this check box is selected, the peak display of the spectrum of the voice data played back is recorded.

4.3.4 Export settings tab



<1> ADPCM encoder:

This field lists the available ADPCM libraries stored in the ADPCM directory of CvADPCM. A library to be used cannot be selected from this list. A library can be selected when exporting is executed.

<2> Command to export the sound data:

This text box is used to specify a command to be transferred to the sound board connected via the COM port. The default value is ExpSnd.exe in the directory where CvADPCM has been installed. Usually do not change the content.

<3> COM port:

Select a COM port number to which a sound board such as TK-78K0R/KG3+Voice is assigned.

<R> **Remark** TK-78K0R/KG3+Voice is a product of TESSERA TECHNOLOGY INC..
Phone: 81-44 271-7533 TESSERA TECHNOLOGY INC.

4.4 Serial Transfer

CvADPCM has a function to transfer compressed data to an external device, such as TK-78K0R/KG3+Voice, through serial connection.

<R> **Remark** TK-78K0R/KG3+Voice is a product of TESSERA TECHNOLOGY INC..
Phone: 81-44 271-7533 TESSERA TECHNOLOGY INC.

4.4.1 Communication specifications

The communication specifications of the serial transfer function are as follows.

<1> Output port
An output port can be specified in the COM port drop-down list on the Export settings tab in the Settings dialog box.

<2> Transfer rate, data bit length, parity bit, and stop bit length
These parameters can be specified in the Command to export the sound data text box on the Export setting tab in the Settings dialog box.

4.4.2 Communication error

If error message “Exporting has failed. code = 2” is displayed, check the setting of the COM port by referring to **4.3.5 Export settings tab**. This error message may be displayed if the target device is not connected to the port specified by the COM port drop-down list box on the Export settings tab.

APPENDIX A INDEX

APPENDIX B REVISION HISTORY

B.1 Major Revisions in This Edition

Page	Description
CHAPTER 1 OVERVIEW	
p. 11	Modification of **Remark**
CHAPTER 4 OPERATIONS	
pp. 18, 21, 22	Modification of **Remark** in **4.2 Export Dialog Box**, **4.3.4 Export settings tab**, and **4.4 Serial Transfer**

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