

WaveArtist™ Designs

Audio/Telephony Combo Card Accelerator Kit

User's Guide

Order No. 1109
Rev. 1, June 9, 1997

NOTICE

Information furnished by Rockwell International Corporation is believed to be accurate and reliable. However, no responsibility is assumed by Rockwell International for its use, nor any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent rights of Rockwell International other than for circuitry embodied in Rockwell products. Rockwell International reserves the right to change circuitry at any time without notice. This document is subject to change without notice.

WaveArtist is a trademark of Rockwell International

CROSSTALK is a registered trademark of Digital Communications Associates, Inc.

OrCAD is a trademark of OrCAD L.P.

ProComm is a trademark of Datastorm Technologies, Inc.

Microsoft, DOS, Windows, Windows NT, DirectSound and Windows Sound System are trademarks of Microsoft Corporation.

Sound Blaster, Sound Blaster Pro/16 and Wave Blaster are trademarks of Creative Technology, Inc.

K56flex is a trademark of Lucent Technologies and Rockwell International.

Table of Contents

1. INTRODUCTION	1
1.1 OVERVIEW	1
1.2 DESIGN CONTENTS	1
1.2.1 TJ56-D680 (RCV56ACF/SP/RWA010/RWA030/RWA035, RCV56ACF/SP/RWA011/RWA030/RWA035 Reference Boards)	2
1.2.2 AK30-D190 (RWA010/RWA030/RWA035 Reference Boards)	2
1.2.3 AK28-D640 (RCV336ACF/SP/RWA300, RCV336ACF/SP/RWA100 Reference Boards)	3
1.2.4 AK28-D680 (RCV336ACF/SP/RWA010/RWA030, RCV336ACF/SP/RWA011/RWA030 Reference Boards)	4
1.2.5 AK30-D100 (RWA300 Reference Boards)	5
1.2.6 AK30-D110 (RWA010/RWA030 Reference Boards)	6
1.2.7 AK30-D130 (RWA030 WaveBlaster Reference Board)	7
1.3 GENERAL REFERENCE BOARD FEATURES	8
1.3.1 Modem	8
1.3.2 Telephony	8
1.3.3 Audio	10
1.3.4 Hardware	11
2. APPLICABLE DOCUMENTS	12
3. ABOUT THE DESIGNS	13
3.1 WAVEARTIST REFERENCE BOARDS	13
3.2 SOFTWARE	13
3.2.1 OrCAD/Gerber Files	13
3.2.2 Disks - Windows 3.1 and Windows 95 Install and Drivers	13
3.2.3 Disk - Sample WAV and MIDI files	14
3.3 SAFETY	14
4. INSTALLING WAVEARTIST HARDWARE	15
4.1 INSTALLING THE WAVEARTIST REFERENCE BOARDS	15
4.1.1 Assumptions	18
4.1.2 Connecting the CD-ROM drive to the WaveArtist boards	18
4.1.3 Installing the WaveArtist board into the PC	19
4.1.4 Connecting External Cables to the WaveArtist board	19
5. INSTALLING WAVEARTIST DRIVER SOFTWARE	21
5.1 INSTALLING WAVEARTIST DRIVERS IN WINDOWS 95 ENVIRONMENT	21
5.1.1 Initial Install of WaveArtist Win '95 Drivers	21
5.1.2 Upgrade Install of WaveArtist Win '95 Drivers (Rev. 2.3 and Above)	22
5.1.3 Uninstall of WaveArtist Win '95 Drivers	22
5.1.4 Install WaveArtist Win '95 Drivers Subprocedure	22
5.1.5 Uninstall WaveArtist Win '95 Drivers Subprocedure	25
5.2 INSTALLING WAVEARTIST DRIVERS IN WINDOWS 3.1x ENVIRONMENT	27

WaveArtist Accelerator Kit User's Guide

5.2.1 Initial Install of WaveArtist Win '3.1 Drivers	28
5.2.2 Upgrade Install of WaveArtist Win '3.1 Drivers	28
5.2.3 Uninstall WaveArtist Win '3.1 Drivers	28
5.2.4 Common Install of WaveArtist Win '3.1 Drivers	29
5.3 INSTALLING WAVEARTIST DRIVERS IN DOS ENVIRONMENT	30
5.3.1 WaveArtist PnP Configuration Utility (SetWaPnp).....	30
5.4 PROGRAMMING THE PNP RESOURCE DATA EEPROM.....	32
5.5 EXTERNAL 3D SPATIALIZATION HARDWARE DESIGNS	34
6. WINDOWS 95 APPLICATIONS.....	36
6.1 OPERATING THE WAVEARTIST MIXER.....	36
6.1.1 Playback Controls	36
6.1.2 Recording Controls.....	37
6.2 AUDIO	38
6.3 MODEM.....	42
6.3.1 Using HyperTerminal to Test the Modem	42
7. AUDIO ENHANCEMENTS	46
7.1 RWA035 EFFECTS PATCHES FOR 256K DRAM.....	46
7.2 SERIAL WAVE DEVICE VS WAVE WRAPPER DEVICE.....	46
7.3 ROCKWELL SYSEX TO ADJUST HOMAC DECOMPRESSION FILTER GAIN AND CUT-OFF FREQUENCY	46
7.4 CREATING CUSTOM PATCHES AND SAMPLES FOR THE WAVEARTIST RWA030	47
7.5 TO PRODUCE A CD-ROM FOR THE TWO DISKETTE WAVEARTIST WINDOWS '3.1 DRIVERS	48
8. MODEM OPERATION	50
8.1 CONFIGURING THE COMMUNICATIONS SOFTWARE	50
8.2 OPERATING THE COMMUNICATIONS SOFTWARE.....	50
8.2.1 Manual Operation using AT Commands	50
8.3 OPERATION IN FAX MODE	50
8.4 OPERATION IN VOICE MODE	50
8.5 EXTENSION PICKUP OPERATION	51
8.6 UPGRADING THE MODEM FIRMWARE WHEN USING FLASH PARTS.....	51
9. TELEPHONY OPERATION	52
9.1 OPERATION IN SPEAKERPHONE MODE (AT#VLS=6).....	52
9.1.1 Manual Operation Using "AT" Commands With Windows 95 Hyperterminal and Willow Pond Media Rack Mixer Utility	52
9.1.2 Originating a Voice Call in Speakerphone Mode.....	52
9.1.3 Answering a Voice Call in Speakerphone Mode	52
9.2 WAVEARTIST SUPPORT MODES.....	54
9.2.1 #VLS=7 - Muting the local handset during phone conversation - Music on Hold (Valid after Voice On-line mode)	54
9.2.2 #VLS=8 - Recording a handset conversation on phone line (Valid after Voice On-line mode)	56
9.2.3 #VLS=9 - Recording/Playback from HANDSET through the WaveArtist Audio Chip (valid after Voice On-line mode).....	56

WaveArtist Accelerator Kit User's Guide

9.2.4 Switching Between #VLS Settings	57
9.2.5 Reporting of Local Handset Status.....	57
9.2.6 Notes	57
9.3 OPERATION IN AUDIOSPAN MODE	57
9.3.1 Manual Operation Using Terminal Mode.....	58
9.3.2 Commands Supported by AudioSpan	59
9.3.3 AudioSpan Examples	61
10. TROUBLESHOOTING	66
10.1 RESOLVING HARDWARE CONFLICTS	66
10.1.1 Windows 95 Environment.....	67
10.1.2 Windows 3.1 Trouble Shooting	70
10.1.3 EEPROM Programming Troubleshooting.....	70
10.2 LAYOUT GUIDELINES.....	72
10.3 FREQUENTLY ASKED QUESTIONS (FAQs)	73

List of Tables

Table 1. WaveArtist Accelerator Kit/Reference Board Features	1
Table 2. WaveArtist Device Type Identification	33
Table 3. PnP Resource File versus Configuration	33
Table 4. Accelerator Kit PnP Resource File Usage (Win'95 Ver 2.33 and Above)	34
Table 5. Volume Control - Playback Option	36

List of Figures

Figure 1. AK28-D640, AK34-D220, AK34-D230 and AK34-D240 General Layout and Interface Connections	15
Figure 2. AK28-D680, AK34-D160, AK34-D170 and AK34-D180 General Layout and Interface Connections	16
Figure 3. AK30-D100 General Layout and Interface Connections	16
Figure 4. AK30-D130 General Layout and Interface Connections	17
Figure 5. CD-ROM Ribbon Cable Connections	18
Figure 6. External Connections on the Audio Combo Type Boards	20

WaveArtist Accelerator Kit User's Guide

This page is intentionally blank.

1. INTRODUCTION

1.1 OVERVIEW

The Rockwell WaveArtist Accelerator Kits are complete WaveArtist reference hardware design packages prepared for manufacturers who are interested in accelerating the development and production of integrated modem/telephony/audio and audio-only cards for the PC platform. The Accelerator Kits contain a WaveArtist reference design hardware board, OrCAD files, and Gerber files which allow the manufacturer to go directly into production of the reference design hardware as supplied or rapidly after customization of the reference design to meet the manufacturer's unique requirements. WaveArtist software drivers for DOS, Windows 3.1, Windows 95, Windows NT, PnP EEPROM files, and WaveArtist accelerator Kit user's manual are included to allow immediate installation and operation of the reference design board. Other supplied documents include device set designer's guides and reference design schematics. Use of a WaveArtist Accelerator Kit can save the manufacturer engineering resources and significantly reduce the product's time-to-market.

1.2 DESIGN CONTENTS

The WaveArtist Accelerator Kits and/or Reference Boards and their features are listed in Table 1.

Table 1. WaveArtist Accelerator Kit/Reference Board Features

Board Name	PCB No.	Sound Features Supported				Modem Features	DAA	Comments
		WaveArtist Device(s)	Wavetable w/ ROM	DirectSound DRAM	RWA035 Special Effect DRAM			
TJ56-D680-003	TJ56-D680-003	RWA010/RWA030/RWA035	Yes w/2MB	Yes w/512KB	Yes w/128KB	56Kbps	USA	AK Kit OK
AK30-D130-003	AK30-D130-003	RWA030	Yes w/2MB	n/a	n/a	n/a	n/a	AK Kit OK
AK30-D190-003	AK30-D190-003	RWA010/RWA030/RWA035	Yes w/2MB	Yes w/512KB	Yes w/128KB	n/a	n/a	AK Kit OK
AK28-D640-061	AK28-D645-009	RWA300/RWA100	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	USA	AK Kit OK
AK28-D680-031	AK28-D685-007	RWA010/RWA011/RWA030	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	USA	AK Kit OK
AK30-D100-021	AK30-D105-003	RWA300/RWA100	Yes w/2MB	n/a	n/a	n/a	n/a	AK Kit OK
AK30-D110-021	AK30-D115-003	RWA010/RWA011/RWA030	Yes w/2MB	n/a	n/a	n/a	n/a	AK Kit OK
AK34-D160-001	AK34-D165-001	RWA010/RWA030	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	FRA	Sample OK
AK34-D170-001	AK34-D165-001	RWA010/RWA030	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	UK	Sample OK
AK34-D180-001	AK34-D165-001	RWA010/RWA030	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	GER	Sample OK
AK34-D220-001	AK34-D235-001	RWA300	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	FRA	Sample OK
AK34-D230-001	AK34-D235-001	RWA300	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	UK	Sample OK
AK34-D240-001	AK34-D235-001	RWA300	Yes w/2MB	Yes w/512KB	Yes w/128KB	Yes	GER	Sample OK

Notes:
All boards support Joystick and MIDI interfaces.

WaveArtist Accelerator Kit User's Guide

1.2.1 TJ56-D680 (RCV56ACF/SP/RWA010/RWA030/RWA035, RCV56ACF/SP/RWA011/RWA030/RWA035 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)
RCV56ACF/SP/RWA010-RWA011 Reference Board (TJ56-D680)
WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)
WaveArtist 010 Audio System Designer's Guide (Order No. 1101)
WaveArtist 030 Audio System Designer's Guide (Order No. 1103)
RC56ACF/SP Modem Designer's Guide (Order No. 1105)
AT Command Reference Manual (Order No. 1048)
DAA Parts Specifications (K56 updated version)
Additional Related Parts Specifications
PCB Fab. Drawing (TJ56-D685)
PCB Assembly Drawing (TJ56-D680)
Schematic Drawing (TJ56-X680)
Vendor Parts List (TJ56-D680)
Bracket Drawing (TC00-D321)
Warranty Card (Order No. W-31)
Telex Mic
Dangle Cable and Telephone Line Cord
3 1/2" Floppy Disks for IBM PC containing:
- OrCAD schematic files.
- Gerber files (TJ56-D685-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs
- Sample Wave and MIDI files

1.2.2 AK30-D190 (RWA010/RWA030/RWA035 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)
RWA010/RWA030/RWA035 Reference Board (AK30-D190)
WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)
WaveArtist 010 Audio System Designer's Guide (Order No. 1101)
WaveArtist 030 Audio System Designer's Guide (Order No. 1103)
WaveArtist 035 Audio System Device Data Sheet (MD)
Additional Related Parts Specifications
PCB Fab Drawing (AK30-D195)
PCB Assembly Drawing (AK30-D190)
Schematic Drawing (AK30-X190)
Vendor Parts List (AK30-D190)

WaveArtist Accelerator Kit User's Guide

Bracket Drawing (AK30-D101)

Warranty Card (Order No. W-31)

Plantronics Headset

3 1/2" Floppy Disks for IBM PC containing:

- OrCAD schematic files
- Gerber files (AK30-D195-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs
- Sample Wave and MIDI files

1.2.3 AK28-D640 (RCV336ACF/SP/RWA300, RCV336ACF/SP/RWA100 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)

RCV336ACF/SP/RWA300-RWA200-RWA100 Reference Board (AK28-D640)

WaveArtist 100, 200 and 300 Audio System Devices Data Sheet (MD151)

WaveArtist 100, 200 and 300 Audio System Designer's Guide (Order No. 1104)

RCV336ACF/SP Modem Designer's Guide (Order No. 1046)

AT Command Reference Manual (Order No. 1048)

DAA Parts Specifications

Additional Related Parts Specifications

PCB Fab Drawing (AK28-D645)

PCB Assembly Drawing (AK28-D640)

Schematic Drawing (AK28-X640)

Vendor Parts List (AK28-D640)

Bracket Drawing (TC00-D321)

Warranty Card (Order No. W-31)

Telex Mic

Dangle Cable and Telephone Line Cord

3 1/2" Floppy Disks for IBM PC containing:

- OrCAD schematic files.
- Gerber files (AK28-D645-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs.
- Sample Wave and MIDI files

WaveArtist Accelerator Kit User's Guide

1.2.4 AK28-D680 (RCV336ACF/SP/RWA010/RWA030, RCV336ACF/SP/RWA011/RWA030 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)
RCV336ACF/SP/RWA010-RWA011 Reference Board (AK28-D680)
WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)
WaveArtist 010 Audio System Designer's Guide (Order No. 1101)
WaveArtist 030 Audio System Designer's Guide (Order No. 1103)
RC336ACF/SP Modem Designer's Guide (Order No. 1046)
AT Command Reference Manual (Order No. 1048)
DAA Parts Specifications
Additional Related Parts Specifications
PCB Fab. Drawing (AK28-D685)
PCB Assembly Drawing (AK28-D680)
Schematic Drawing (AK28-X680)
Vendor Parts List (AK28-D680)
Bracket Drawing (TC00-D321)
Warranty Card (Order No. W-31)
Telex Mic
Dangle Cable and Telephone Line Cord
3 1/2" Floppy Disks for IBM PC containing:
- OrCAD schematic files.
- Gerber files (AK28-D685-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs
- Sample Wave and MIDI files

WaveArtist Accelerator Kit User's Guide

1.2.5 AK30-D100 (RWA300 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)

RWA300-RWA100 Reference Board (AK30-D100)

WaveArtist 100 and 300 Audio System Devices Data Sheet (MD151)

WaveArtist 100 and 300 Audio System Designer's Guide (Order No. 1104)

Additional Related Parts Specifications

PCB Fab. Drawing (AK30-D105)

PCB Assembly Drawing (AK30-D100)

Schematic Drawing (AK30-X100)

Vendor Parts List (AK30-D100)

Bracket Drawing (AK30-D101)

Warranty Card (Order No. W-31)

Telex Mic

3 1/2" Floppy Disks for IBM PC containing:

- OrCAD schematic files
- Gerber files (AK30-C105-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs
- Sample Wave and MIDI files

WaveArtist Accelerator Kit User's Guide

1.2.6 AK30-D110 (RWA010/RWA030 Reference Boards)

Description

Accelerator Kit User's Guide (Order No. 1109)
RWA010/RWA030 Reference Board (AK30-D110)
WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)
WaveArtist 010 Audio System Designer's Guide (Order No. 1101)
WaveArtist 030 Audio System Designer's Guide (Order No. 1103)
Additional Related Parts Specifications
PCB Fab Drawing (AK30-D115)
PCB Assembly Drawing (AK30-D110)
Schematic Drawing (AK30-X110)
Vendor Parts List (AK30-D110)
Bracket Drawing (AK30-D101)
Warranty Card (Order No. W-31)
Plantronics Headset
3 1/2" Floppy Disks for IBM PC containing:
- OrCAD schematic files
- Gerber files (AK30-D115-xxx.PA)
- Windows 3.1 and Windows 95 drivers and install programs
- Sample Wave and MIDI files

WaveArtist Accelerator Kit User's Guide

1.2.7 AK30-D130 (RWA030 WaveBlaster Reference Board)

Description

Accelerator Kit User's Guide (Order No. 1109)
RWA030 Reference Board (AK30-D130)
WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)
WaveArtist 030 Audio System Designer's Guide (Order No. 1103)
PCB Fab Drawing (AK30-D135)
PCB Assembly Drawing (AK30-D130)
Schematic Drawing (AK30-X130)
Vendor Parts List (AK30-D130)
Warranty Card (Order No. W-31)
3 1/2" Floppy Disks for IBM PC containing:
- OrCAD schematic files
- Gerber files (AK28-D685-xxx.PA)
- Sample Wave and MIDI files

1.3 GENERAL REFERENCE BOARD FEATURES

1.3.1 Modem

Fax and Data Modem (56Kbps additions to 33.6 Kbps devices)

- K56flex
 - 33600 bps full-duplex data modem
 - 14400 bps half-duplex fax modem
 - AudioSpan
 - ITU-T interoperable G.729 and G.729 Annex A with interoperable G.729 Annex B
 - V.80 or Rockwell Video Ready Mode synchronous access mode (SAM) supports host-based communication protocols(otion)
 - flash memory support
 - Sleep mode
 - Serial async. data; parallel async. data.

Fax and Data Modem (33.6Kbps)

- 33600 bps full-duplex data modem
 - V.34 28800/14400/12000/9600/7200/4800 bps, V.32bis 14400/12000/9600/7200/4800 bps, V.32 9600/4800 bps, V.22 bis 2400 bps, V.22A/B 1200 bps, V.23 1200 bps FSK and V21 300 bps recommendations, and meets Bell 212A 1200 bps and 103 300 bps standards
 - V.42 LAPM, MNP2-4 , and MNP 10 Error Correction; V.42bis/MNP5 Data Compression modes
 - MNP 10EC enhanced cellular performance
- 14400 bps half-duplex fax modem
 - Group 3 fax modes supporting V.33 14400/12000/9600/7200 bps, V.17 14400/12000/9600/7200 bps, V.29 9600/7200 bps, and V.27 ter 4800/2400 bps transmit/receive, V.21 Channel 2 300 bps transmit and receive, EIA-578 Service Class 1 commands, and EIA-592 Service Class 2 commands
 - Supports T.30 protocol
- Parallel (16550A UART-compatible) interface supporting DTE speeds up to 115.2 kbps
- Software programmable COM ports and IRQ
 - Supports COM1, COM2, COM3, and COM4
 - Supports IRQ3, IRQ4, IRQ5, IRQ7, IRQ10, IRQ11 and IRQ15
- Implements enhanced "AT" command set
- On-board DAA designed to be compliant with FCC part 68 and DOC (for U.S. and Canada)
- Reference Board design compliant with FCC part 15B
- Supports Rockwell PnP interface ISA Bus Interface Device

1.3.2 Telephony

Voice

- Voice mode supporting enhanced 4- and 2-bit ADPCM compression/decompression, tone detection/generation, call discrimination, and concurrent DTMF detection
- Caller ID detect and distinctive ring detect
- Playback of voice messages through telephone line and speaker output
- 8-bit monophonic audio data encoding at 11.025 kHz or 7200 Hz

WaveArtist Accelerator Kit User's Guide

- VoiceView alternating voice and data
- Microsoft Unimodem V and Serial Wave Device inf file support

Full-Duplex Speakerphone

- Acoustic and line echo cancellation
- Microphone gain and muting
- Speaker volume control and muting
- Room monitor

WaveArtist Accelerator Kit User's Guide

AudioSpan Simultaneous Voice and Data

- AudioSpan analog simultaneous voice and data with handset, full-duplex speakerphone (FDSP), or headset over a single telephone line to an AudioSpan-compatible modem
- ITU-T V.61 modulation (4.8 kbps data plus audio), ML144 modulation (4.8 to 9.6 kbps data plus audio), and ML288 modulation (4.8 to 14.4 kbps data plus audio)
- Audio/silence detection (ML144) and handset echo cancellation
- Handset, headset, or half-duplex speakerphone

1.3.3 Audio

Waveform Audio

- 8-bit and 16-bit PCM waveform audio, record and playback from 4 kHz to 44.1 kHz sample rate, mono and stereo
- Software compatible with Creative Labs Sound Blaster and Sound Blaster Pro in the DOS environment and Microsoft Windows Sound System API in the Windows 3.1 environment
- Microphone input
- Line input
- Line output supporting Plantronics headsets and powered speakers
- I/O port, DMA channel and interrupt is software programmable
- 16-bit stereo audio in a single mixed-signal device
- Simultaneous (full-duplex) record/playback of voice, sound and music
- Microsoft Wave Wrapper inf file support

MIDI Synthesizer.

- Yamaha OPL3- and OPL2-compatible FM music synthesis with no external DAC
- Software compatible with AdLib, Sound Blaster, Sound Blaster Pro and Windows Sound System API

MIDI Interface

- Roland MPU-401 MIDI UART-compatible interface
- External MIDI I/O through joystick connector
- Digital and analog joystick support

CD-ROM Interface

- Supports Enhanced IDE CD-ROM (16-bit) controller interface
- Supports Sony CD audio interface (4-pin, 0.1 inch spacing)

Audio Mixer and CODEC

- Windows Sound System 2.0/Microsoft Mixer Manager compatible
- Allows recording from microphone, line-in, modem or speakerphone speaker out, telephone line, and CD-audio
- 6 channel (5 stereo, 1 mono) input analog mixer
- 16-bit delta sigma ADC and DAC with >80 dB SNR
- Playback mix consists of digital audio, MIDI synthesizer, FM synthesis, Wavetable synthesis, line-in, modem or speakerphone speaker out and CD-audio
- Playback mix may be directed to telephone line for music-on-hold applications using #VLS=7 during speakerphone, handset or headset mode only, not during AudioSpan SVD

WaveArtist Accelerator Kit User's Guide

Music Processor (associated with RWA300, RWA030)

- Audio by Kurzweil
- General MIDI compatible supporting 32 voices at 44.1 KHz
- Basic effects for reverb, chorus and 3D spatialization
- Treble and bass equalization
- Interface to 2MB or 1MB wavetable ROM
- Interface to sound sample DRAM up to 8 MB
- Hardware-based wavetable synthesis

RWA135 Effects Processor (Optional add-on chip)

- Full effects for reverb, chorus, delay and numerous other patches (128KB and 256KB patch sets available)
- Spatial placement effects
- Interface up to 512 kB DRAM

Other Special Design Features

- Single Crystal operation
- ISA Plug-and-Play (PnP) with modem support
- Game port compatible with internal timers
- Compact 208-pin ball grid array (BGA) packaging
- Full 16-bit address decode for PnP and I/O ports
- Supports in-circuit programming of PnP resource data, Visual Basic program available
- Production test program for board verification, available in DOS, Windows 3.x and Windows '95.
- DOS based mixer
- GUI based PnP resource data file editor program (PRO)

1.3.4 Hardware

- PCB is 2-layer, PC half-card size
- Bracket contains one RJ-11 jack for *Splitter Cable, Microphone-In (mono mini jack), Line-In (stereo mini jack), Line-Out (stereo mini jack), Speaker-Out (stereo mini jack) and DB-15 for joystick and MIDI I/O.

*Splitter Cable designed to support handset and telephone line connections. Cable can be obtained through any vendor including : Winstronics International Inc, 46560 Fremont Blvd., Suite 112, CA 94538 , Phone (510)226-0546.

Telex Microphone: designed by Telex Communications. The manufacturer P/N is 300262-014, our cost is \$4.25 per unit. The Rockwell pic spec number for the Telex mic is 183R02-001. Telex phone number is (612) 884-4051.

2. APPLICABLE DOCUMENTS

WaveArtist 100 and 300 Audio System Devices Data Sheet (MD151)

WaveArtist 100 and 300 Audio System Devices Designer's Guide (Order No. 1104)

WaveArtist 010 and 030 Audio System Devices Data Sheet (MD152)

WaveArtist 010 Audio System Device Designer's Guide (Order No. 1101)

WaveArtist 030 Music Processor Designer's Guide (Order No. 1103)

RCVDL56ACF/SVD, RCV56ACF/SVD, and RCV336ACF/SVD Modems Designer Guide (Order No. 1105)

RCV336ACF/SP Modem Data Sheet (Order No. MD150)

RCV336ACF/SP Modem Designer's Guide (Order No. 1046)

AT Command Reference Manual (Order No. 1048)

3. ABOUT THE DESIGNS

3.1 WAVEARTIST REFERENCE BOARDS

All WaveArtist reference boards are ISA bus based integrated modem/telephony/audio boards and audio-only type boards. Whether the modem is a 33.6 Kbps or a 56 Kbps based design, boards based on both types of Datapumps have been designed. The RCV56ACF/SP/RWA010/RWA030/RWA035 utilizes the Rockwell RWA010 Audio System Device in TQFP type packaging. The RCV336ACF/SP/RWA300-100 board utilizes the Rockwell RWA300 or RWA100 Audio System Devices in BGA type packaging and the Rockwell RCV336ACF/SP modem device. The RCV336ACF/SP/RWA010/RWA030 utilizes the same audio devices as listed above but in TQFP and PQFP packaging and the Rockwell RCV336ACF/SP modem device. The audio-only boards utilize the same audio devices in the listed packaging options.

The exception to the above cards is the WaveBlaster type card namely the AK30-D130 which is not ISA based, but instead has a standard WaveBlaster connector on it and will easily connect to any sound card with the appropriate WaveBlaster header on it.

The audio portion of WaveArtist boards provide 16-bit stereo audio with simultaneous (full-duplex) record/playback, ISA Plug and Play, FM synthesis, Wavetable synthesis, delta sigma ADC and DAC, DirectSound, EIDE CD-ROM interface and Joystick support. DirectSound hardware acceleration is only supported if a DRAM is populated on the board (see sheet 2 of the appropriate schematic). The modem portion provides either 56 Kbps or 33.6 kbps data, Class 2 fax, simultaneous voice and data, speakerphone and voice record/playback, depending on which datapump has been populated on the board. The boards are completely software configurable and are supported in both Microsoft Windows '3.1, Windows 95, Windows NT and DOS environments.

If the board is populated with the RWA300 or the RWA010/RWA030, the RWA135 Effects Processor Upgrade is an option that may be added (see sheet 2 of appropriate schematic).

On the modem side, a number of population options are also available. These include Extension pickup which will be supported once the firmware has been completed. The DAA portion has been configured to support European countries U.K., Germany and France in other Accelerator kits namely: AK34-D160, D170, D180 and AK34-D220, D230, D240.

3.2 SOFTWARE

Software is supplied on 3 1/2" floppy disks:

3.2.1 OrCAD/Gerber Files

The OrCAD schematic files and Gerber files for the WaveArtist reference boards are organized with the following directory structure:

- The OrCAD directory contains the bill of materials and schematics of the Reference Board. The bill of materials specifies all the parts that are required to produce the Reference Board. The schematic and library files are in 32-bit OrCAD-SDT format.
- The Gerber directory contains the Gerber files, Embedded Aperture List, Drill Tool Table, Drill coordinate file and Plot files for the Reference Board. All artwork and drill files used by board manufacturers to produce printed circuit boards are included. Read the "README.TXT" ASCII file in the supplied diskette for instructions to access these files.

The latest firmware for the modem may be accessed by dialing the Broadcast Bulletin Service (BBS). Please contact your local Field Applications Engineer for further information. Instructions on how to use the Flash Loader utility from AMD in order to upgrade the modem firmware while the WaveArtist is plugged into a PC that is turned on, please refer to the appropriate section below.

3.2.2 Disks - Windows 3.1 and Windows 95 Install and Drivers

The Windows installation, configuration and driver software are supplied on three disks. The files are identified as:

WaveArtist Win '3.1 (drivers and install programs for Windows 3.1)

WaveArtist Accelerator Kit User's Guide

WaveArtist Win '95 (drivers and install programs for Windows 95)

The Windows NT based installation, configuration and driver software are supplied via our Internal WEB page. Please ask your local FAE for support.

3.2.3 Disk - Sample WAV and MIDI files

A sample set of WAV and MIDI files are supplied for your setup testing and demonstration of the WaveArtist boards. The floppy disk is identified as:

WaveArtist Sample wave and midi files

3.3 SAFETY

The NFPA 70, National Electrical Code (NEC), paragraph 800-51(i), requires equipment that is intended to be electrically connected to a telecommunications network to be "listed for the purpose". This listing requirement became effective for such equipment July 1, 1991. A nationally recognized testing laboratory (NRTL) can assist in testing and selecting the appropriate listing category and safety standard for this equipment depending on marketing requirements for the product.

4. INSTALLING WAVEARTIST HARDWARE

4.1 INSTALLING THE WAVEARTIST REFERENCE BOARDS

Perform the following to install a WaveArtist Reference Board to your IBM PC-compatible computer.

Typical WaveArtist reference boards are illustrated in Figure 1 for AK28-D640, AK34-D220, AK34-D230 and AK34-D240), Figure 2 (TJ56-D680, AK28-D680, AK34-D160, AK34-D170 and AK34-D180), Figure 3 (AK30-D100), and Figure 4 (AK30-D130).

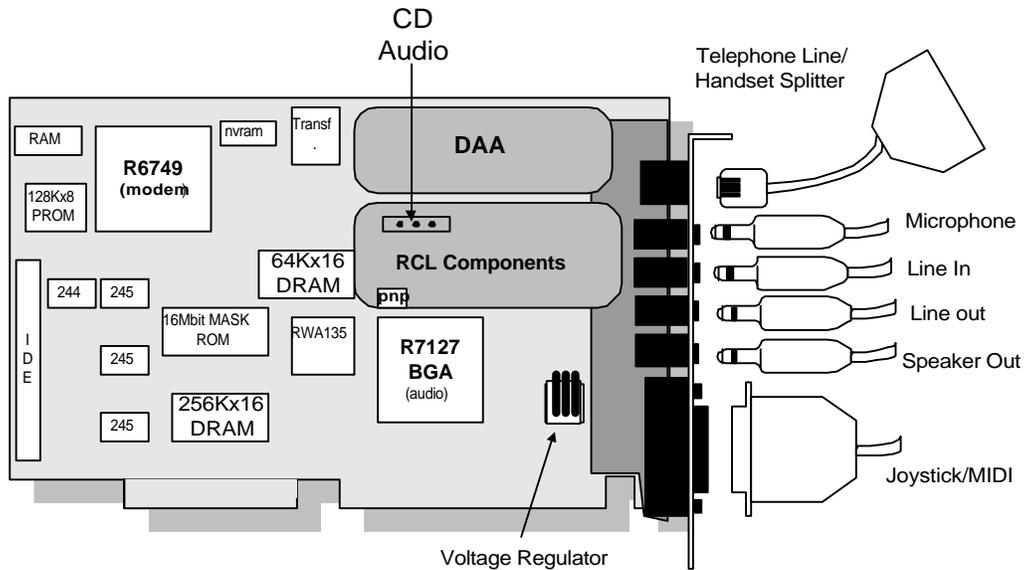


Figure 1. AK28-D640, AK34-D220, AK34-D230 and AK34-D240 General Layout and Interface Connections

WaveArtist Accelerator Kit User's Guide

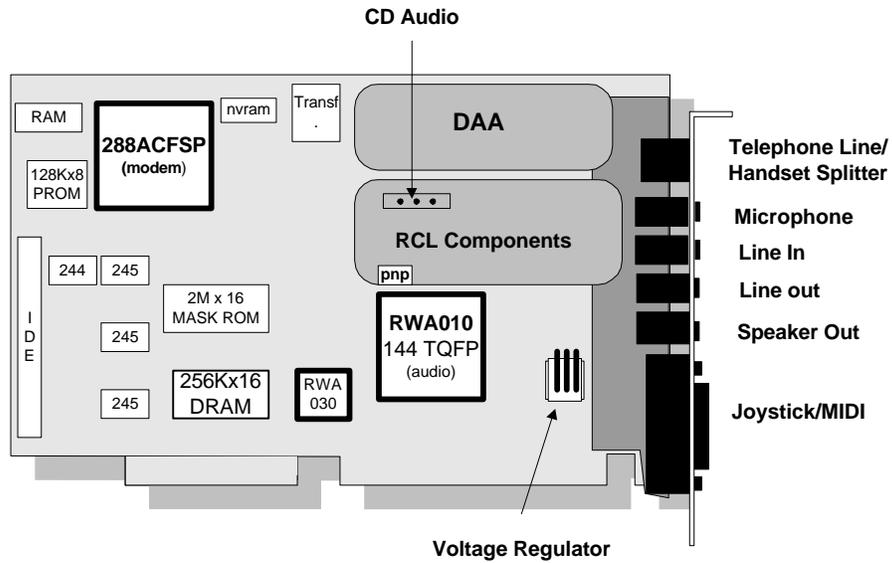


Figure 2. TJ56-D680, AK28-D680, AK34-D160, AK34-D170 and AK34-D180 General Layout and Interface Connections

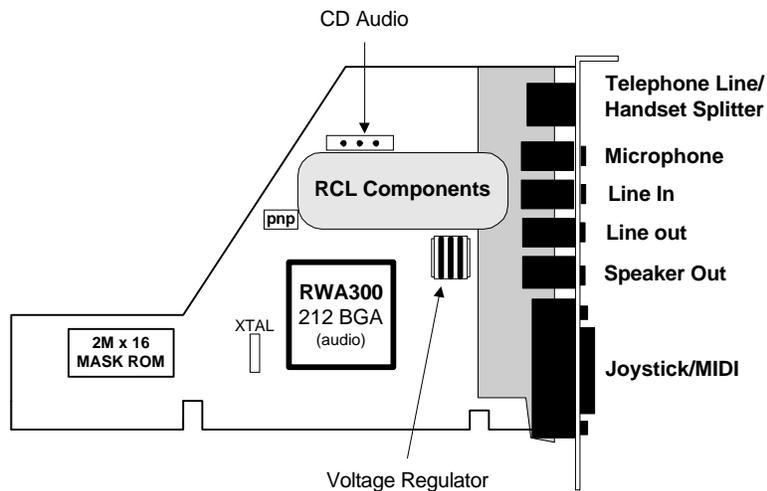


Figure 3. AK30-D100 General Layout and Interface Connections

WaveArtist Accelerator Kit User's Guide

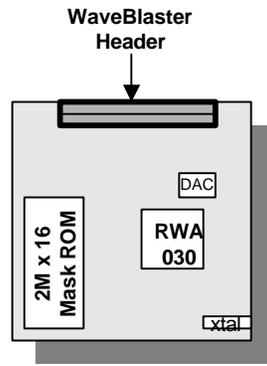


Figure 4. AK30-D130 General Layout and Interface Connections

4.1.1 Assumptions

The following instructions assume that:

- A spare 16-bit ISA slot is available in your PC.
- An IDE CD-ROM drive, if installed, has been installed using the manufacturer's hardware installation procedure.

NOTES

1. ***Do not install any interface card that may come with the drive. Also, all IDE interfaces on all WaveArtist boards have been disabled.***
2. ***If the CD-ROM ribbon cable is already connected to the secondary IDE connector on your PC motherboard, leave it as is. Do not disconnect!***

4.1.2 Connecting the CD-ROM drive to the WaveArtist boards

The CD-ROM connector is a 40-pin IDE connector supported by multiple drive vendors. Some IDE connector cables have one of their center holes filled in. In such a case, you may punch a small whole into the cable head whose hole is filled in. The hole is filled in to ensure that the user connects the cable to the sound card using the correct connector orientation.

Perform the following steps to connect the CD-ROM drive to the WaveArtist boards:

1. Connect the interface cable from the CD-ROM drive to the IDE CD-ROM interface connector on the WaveArtist board (JP1).

CAUTION

Make sure that the red line on the interface cable is connected to Pin 1 of the interface connector on the WaveArtist board (see Figure 5).

2. Connect the audio cable from the CD-ROM drive to the 4-pin CD audio input connector on the WaveArtist board (see Figure 1).

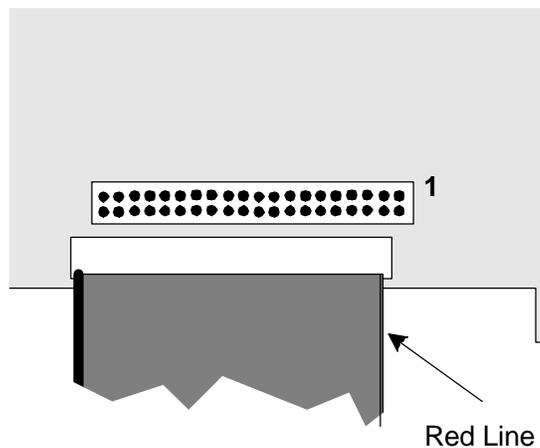


Figure 5. CD-ROM Ribbon Cable Connections

WaveArtist Accelerator Kit User's Guide

4.1.3 Installing the WaveArtist board into the PC

1. If you are installing a WaveArtist that includes a modem, remove any installed audio and modem cards.
2. If you are installing a WaveArtist that does not include a modem, remove any installed audio cards.

NOTE Audio and modem devices installed on the motherboard will be disabled later during WaveArtist Driver software installation.

3. Compare the WaveArtist Driver version on the sticker attached to the WaveArtist board joystick connector with the WaveArtist Win'95 Driver version in the supplied diskette and note the result (same or different). If the versions are different, e.g., the WaveArtist Win'95 Driver is later than the version indicated on the board, the EEPROM must be reprogrammed later during WaveArtist Driver software installation.
4. Insert the WaveArtist board into the PC expansion slot by pushing it down firmly. Anchor the cards mounting bracket with a screw. Put the cover back on the computer.

4.1.4 Connecting External Cables to the WaveArtist board

(See Figure 6.)

CAUTION

DO NOT PUT ANY HEADPHONES ON UNTIL YOU ARE SURE THAT THE SOUND LEVEL WILL NOT DAMAGE YOUR HEARING.

1. Connect a standard RJ11 type telephone cord (Analog phone line only), from the wall jack to the connector labeled "LINE" on the WaveArtist board's splitter cable.
2. Connect a standard RJ11 type telephone cord from the telephone to the side of the splitter cable labeled "HANDSET".
3. Headphones/headsets or powered speakers may be attached to the 1/8" mini jack labeled "SPEAKER". If you are using powered speakers, it is recommended that you attach it to the 1/8" mini jack labeled "LINE-OUT".
4. A microphone can be connected to the 1/8" mini jack labeled "MIC" as an input device for voice/audio recordings. Use an electret or dynamic monaural stereo microphone.
5. If you have a CD player, connect the cable to the input jack labeled "LINE-IN".
6. The joystick/MIDI port is a 15-pin female connector. This port can be connected to any IBM PC compatible joystick with a 15 pin D-sub connector.

WaveArtist Accelerator Kit User's Guide

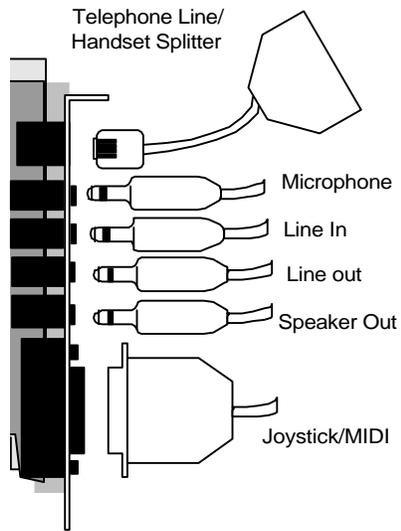


Figure 6. External Connections on the Audio Combo Type Boards

5. INSTALLING WAVEARTIST DRIVER SOFTWARE

This section describes the general installation of the standard set of drivers that is supplied with all WaveArtist boards. The installation is not specific to any particular WaveArtist accelerator kit board.

It is beneficial for the user to read the notes supplied in a number of files that are part of the WaveArtist Windows '95 driver installation files to learn about OEM flexible options. In particular, please read RWA95.inf , FLEXMIX.doc, CDHOWTO.doc.

These procedures assume that any previously installed sound or modem cards are removed or disabled from your PC (Section 4.1). Note that the WaveArtist card has six logical devices, all of which need resources depending upon the resource file programmed into the on-board PnP EEPROM using the EEPROG.exe utility. The latest drivers use one interrupt request (IRQ) for SoundBlaster, one IRQ for modem and one IRQ for the CD-ROM. External 3D Spatialization hardware used in some designs will require special PnP resource data files and editing of the RWA95.inf file supplied with the Windows '95 drivers, see Section 5.1.1.

<p>NOTE If you have downloaded upgraded WaveArtist drivers, copy the WaveArtist Driver (Win '95) files to a floppy disk and name the floppy disk volume "RWA95".</p>

1. If the computer is to be operated in Windows 95, go to Section 5.1.
2. If the computer is to be operated in Windows 3.1x, go to Section 5.2.
3. If the computer is to be operated in DOS, go to Section 5.3.
4. If you want to only reprogram the PnP EEPROM, go to Section 5.4.

5.1 Installing WaveArtist Drivers in Windows 95 Environment

1. If the WaveArtist drivers are to be installed for WaveArtist card with external 3D spatializer hardware, go to Section 5.5.
2. If the WaveArtist drivers are to be installed for the first time, go to Section 5.1.1.
3. If upgraded WaveArtist drivers are to be installed after a previous installation of WaveArtist drivers, go to Section 5.1.2.
4. If the WaveArtist drivers are to be completely removed, go to Section 5.1.3.

5.1.1 Initial Install of WaveArtist Win '95 Drivers

1. If the PC does **not** have built-in sound or modem capabilities (i.e., audio or sound device built-in to the motherboard), go to step 5.
2. If the PC has built-in sound (i.e., audio or sound device built-in to the mother board), turn-on the PC and enter CMOS setup; disable any sound support in your BIOS. You may have to also use the device manager in Windows '95 to give "red marks" to the on-board audio. This would mean that you are disabling the audio. Also, you may have to reassign the on-board audio's resources to non-conflicting ones. Please refer to the Microsoft Windows '95 Reference Manual for more information on how to accomplish the mentioned tasks.

Read the next three sections before saving and exiting CMOS setup.

<p>NOTE If the WaveArtist Driver version on the sticker attached to the WaveArtist board joystick connector is the same as the WaveArtist Win'95 Driver version in the supplied diskette, then the EEPROM does not need to be reprogrammed. Otherwise, the EEPROM must be reprogrammed.</p>

3. If the PnP EEPROM is to be updated with a revised PnP resource data file supplied on the WaveArtist Win'95 installation diskettes as determined during WaveArtist board hardware installation (see Section 4.1.3), go to Step 10.
4. If the PnP EEPROM is **not** to be updated with a revised PnP resource data file supplied on the WaveArtist Win'95 installation diskettes as determined during WaveArtist board hardware installation (see Section 4.1.3), the PC will startup in Windows 95 normal mode. Go to Step 7.

WaveArtist Accelerator Kit User's Guide

5. If the PnP EEPROM is to be updated with a revised PnP resource data file supplied on the WaveArtist Win'95 installation diskettes as determined during WaveArtist board hardware installation (see Section 4.1.3), go to Step 9.
6. Turn on the PC. The PC will start up in Windows 95 normal mode.
7. Install the WaveArtist Win'95 Drivers using the procedure described in Section 5.1.4.
8. Go to Section 6 (WINDOWS 95 APPLICATIONS).
9. Turn on the PC.
10. When the "Starting Windows 95..." message is displayed, immediately press the F8 key. The Microsoft Windows 95 Startup Menu is displayed. Select Safe Mode (select item 3 and press enter or press the F5 key). Windows 95 will start up in Safe Mode.
11. In Safe Mode, reprogram the EEPROM using the procedure described in Section 5.4.
12. Select Start\Shutdown\Restart the Computer? to reboot the PC and restart Windows 95.
13. Install the WaveArtist Win '95 Drivers using the procedure in Section 5.1.4.
14. Go to Section 6 (WINDOWS 95 APPLICATIONS).

5.1.2 Upgrade Install of WaveArtist Win '95 Drivers (Rev. 2.3 and Above)

1. Turn-on the PC. The PC will startup in Windows 95.
2. Uninstall the WaveArtist Win '95 Drivers using the procedure in Section 5.1.5.
3. Reprogram the EEPROM using the procedure described in Section 5.4.
4. Select **Start\Shutdown\Restart the Computer?** to reboot Windows 95.
5. Install the WaveArtist Win '95 Drivers using the procedure in Section 5.1.4.
6. Go to Section 6 (WINDOWS 95 APPLICATIONS).

5.1.3 Uninstall of WaveArtist Win '95 Drivers

1. Turn-on the PC. The PC will startup in Windows 95.
2. Uninstall the WaveArtist Win '95 Drivers using the procedure in Section 5.1.5.
3. Turn-off the PC.
4. Remove the WaveArtist board.
5. Turn-on the PC.
6. Operate in Windows 95 environment.

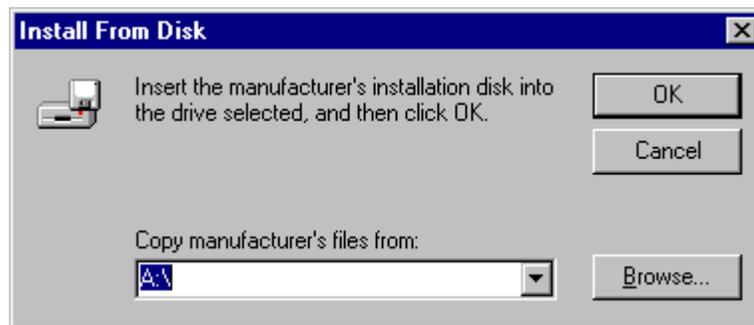
5.1.4 Install WaveArtist Win '95 Drivers Subprocedure

1. Upon Windows 95 startup, if WaveArtist drivers were uninstalled earlier, the **First rebuilding utilities** box may be displayed.
2. The **New Hardware Found** box entitled Rockwell WaveArtist is displayed.

WaveArtist Accelerator Kit User's Guide



3. In the **New Hardware Found** box, select **Driver from disk provided by hardware manufacturer**. Click **OK**. The **Install From Disk** box is displayed.

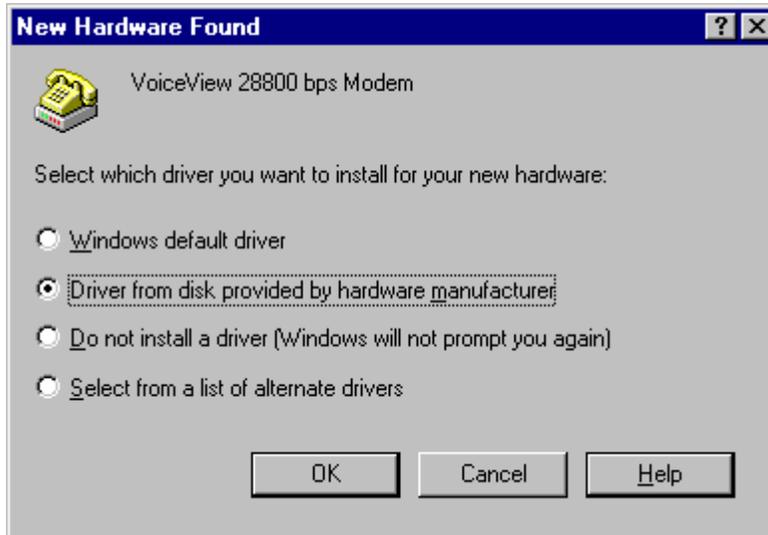


4. Insert the WaveArtist Win '95 Driver disk into your floppy drive.
5. In the **Install From Disk** box, click **OK** for files to be copied from the floppy drive. The WaveArtist audio drivers will load first indicated by a number of **Building driver information base** boxes appearing and disappearing.

NOTE When Updating WaveArtist Drivers, if WaveStream is already installed in your system, do not delete the WaveStream files listed below. You may only need to delete the WaveStream files if you are updating WaveStream by re-installing it, as well. If the user is prompted by Windows '95 during installation, he should say " Don't Overwrite" for the below listed WaveStream files when prompted about the dates being newer than the ones on the new WaveArtist driver floppy. If this is not done, one will wipe out the WaveStream files with a set of "Shell" files from the new WaveArtist driver floppy. The end result will be that WaveStream will not work and you will have to re-install WaveStream again.

6. The **New Hardware Found** box titled "**WaveArtist**" or "**RSS**" or "**VoiceView 28800 bps Modem**" is displayed depending on what version of drivers you are installing. Select **Driver from disk provided by hardware manufacturer**. Click **OK**.

WaveArtist Accelerator Kit User's Guide



7. The **Install From Disk** box is displayed. Click **OK** for files to be copied from the floppy drive.
8. The **Insert Disk** box is displayed. Windows 95 will prompt you to install VoiceView files from **Windows 95 CD-ROM**. Insert a Windows 95 CD-ROM into your CD-ROM drive. Click **OK**.
9. The **Copying Files** box is displayed. Ensure that the directory path is D:\WIN95 (assuming your CD-ROM drive is D drive). Click **OK**.
10. If you have previously used/loaded the VoiceView files, you may skip all prompts for any files required off the **Windows 95 CD-ROM** and continue with the installation. Therefore, you may skip loading the following files: winsock.dll , wsock32.dll, vtdi.386, wsock.vxd, filexfer.cnt, filexfer.exe, filexfer.hlp, fte.dll, vvexe32.exe, wsvv.vxd.
11. When loading drivers for a WaveArtist card that supports the CD-ROM or external 3D audio spatializer, there will be additional prompt boxes which will look like the above boxes shown. The user should respond in the same way as mentioned above, when the **Install From Disk** box is displayed.
12. The **Building driver information base** box is displayed.
13. The **New Hardware Found** box entitled **Wave Device for Voice Modem** is displayed if the MSPHONE (Microsoft Phone) is installed. Select **Driver from disk supplied by manufacturer**. Click **OK**. The **Install From Disk** box is displayed.



WaveArtist Accelerator Kit User's Guide

14. Click **OK** for files to be copied from the floppy drive. The **Building driver information base** box is displayed.
15. After the files are copied, installation is complete. The speaker icon will appear in the right side of the taskbar.
16. Go to Section 6.
17. If the PnP EEPROM has not been programmed to match the WaveArtist driver software just installed, program the EEPROM with the PnP Resource Data provided on the WaveArtist driver disk (see Section 5.4).
18. If the EEPROM is not reprogrammed in the last step, go to Section 6. If the EEPROM is reprogrammed in the last step, select **Start\Shutdown\Restart the Computer?** to reboot Windows 95.

5.1.5 Uninstall WaveArtist Win '95 Drivers Subprocedure

Please note that an Uninstall program has been incorporated into the WaveArtist drivers for Window '95 as of version 4.1 . If you happen to have drivers older than version 4.1, please follow the following procedure. For those who are uninstalling drivers with version 2.41 and higher, simply follow the Windows '95 Add/Remove programs procedures. You will need to look for the program labeled 'WaveArtist Audio Device Drivers' and remove it. Note, this name may be changed by modifying the RWA95.inf file that is part of the WaveArtist drivers.

1. Choose **Start\Settings\Control Panel\System\Device Manager**. The **System Properties** box is displayed.

NOTE Additional devices that might be found depending on what devices are configured initially, which will have to be removed as well are, "WaveArtist IDE Controller" in the **Hard Disk Controllers** section, and "WaveArtist Hardware Analog Spatializer" in the **Sound, video and games controllers** section of the device manager.

2. In Windows Explorer, choose **My Computer\C: drive\Windows\Inf**, In the **Inf** folder, delete all OEMx.inf files that are associated with a modem or WaveArtist. Normally these files are Oem0.inf, Oem1.inf, Oem2.inf, etc. Additional .inf files include the WaveArtist IDE .inf file (WAIDE.inf) and the WaveArtist Hardware Analog Spatializer .inf file, depending on if these devices were configured initially.

NOTE There may be other files with similar names but they will be associated with other card that have been installed, such as a Video card. Do not delete such files, therefore, open the file and look at it before deleting it. The modem file for the WaveArtist will have Rock_15x_.inf mentioned near the top of the file.

3. In Windows Explorer, choose **My Computer\C: Drive\Windows\System**, In the **System** folder, delete the following files:

NOTE You may have a different directory path for these files, but you should be able to find these under \Windows\System folders. These files are not automatically removed by Windows '95 when you remove your audio combo card from your PC. You may have to enter DOS mode in order to delete some of these files if Windows '95 does denies you the right right to delete these files.

Brooktree WaveStream files exist even if WaveStream was NOT installed. In this case the listed files below are shell files copied from the WaveArtist installation floppy. If WaveStream is installed, some of them are overwritten by the real WaveStream drivers. For a complete uninstall, the below listed WaveStream files should be deleted regardless of being a "shell" or a "real" file.

To Update WaveArtist Drivers, if WaveStream is already installed, do not delete the WaveStream files listed below. If the user is prompted by Windows '95 during installation, he should say " Don't Overwrite" for the below listed WaveStream files when prompted about the dates being newer than the ones on the new WaveArtist driver floppy. If this is not done, one will wipe out the WaveStream files with a set of "Shell" files from the new WaveArtist driver floppy. The end result will be that WaveStream will not work and you will have to re-install WaveStream again.

WaveArtist Accelerator Kit User's Guide

Rwa95drv.vxd

Rwa95vxd.vxd

Rwados95.exe

Rwautoex.exe

Setwapnp.exe

Rwa95dos.ini

Rwawsdrv.drv (Associated with the Brooktree WaveStream software)

Msgloop.exe (Associated with the Brooktree WaveStream software)

Wlstream.dll (Associated with the Brooktree WaveStream software)

Vwstream.vxd (Associated with the Brooktree WaveStream software)

7. Return to the calling procedure.

5.2 Installing WaveArtist Drivers in Windows 3.1x Environment

When operating in Windows 3.1, the WaveArtist audio device emulates the Windows Sound System API. You should not have to modify the default settings of the I/O Address, Interrupt and DMA channel. However, Windows 3.1 allows you to change the settings, if needed.

The WaveArtist has an improved installation method for release 1.5 and above. The user is now provided with an option to accept default settings or explicitly select the system resource (e.g., I/O addresses, IRQs, and DMA channel) assignments for the WaveArtist devices. The new installation method uses a new utility whose file name is WaCp.exe (WaveArtist Control Panel). This utility is described in the following item.

The WaveArtist Control Panel (WaCp.exe) is now installed as a control panel applet. WaCp is launched by double-clicking the Rockwell icon added to the Control Panel group window by setup.exe when WaveArtist is installed. WaCp presents a main panel that provides four major options: Audio, MIDI, Modem and Remove. The audio button activates an audio settings panel. The user specifies the settings for 16-bit audio and the Sound Blaster interface through this panel. The MIDI button activates a MIDI port settings panel. The user specifies the settings for the MPU-401 interface through this panel. The Modem button activates a panel that activates the modem settings panel. This panel is disabled if the version of the WaveArtist card is audio only. The modem panel supersedes the Ports applet of the Control Panel to manage the resource assignments for serial ports. The modem panel is described in greater detail in the following item.

The Modem settings panel presents several control features that enable the user to manage the configuration of the serial port associated with the modem. The utility scans the BIOS data area and the com port specifications in the system.ini file to locate all existing com ports on the system. The utility displays the valid com ports it detects in the com port map. It also displays the printer port settings for LPT1 and LPT2 if they exist on the system. The entries presented for existing ports are disabled. The user cannot change these settings through the utility because they reflect the existing system configuration. The comport map visually depicts what com port names (e.g. COM 1, COM 2, etc.) are available on the system. Any com port entry that is blank or enabled represents an available com port name. Note that while DOS and BIOS only recognize four com ports, Windows 3.1 recognizes up to nine com ports. If the user only plans to operate Windows software with the WaveArtist modem, Windows supports com ports 5 through 9 with arbitrarily assigned base I/O addresses and IRQs. Using the modem settings panel ensures that the modem configuration is defined without resource conflicts. The modem panel also supports two check boxes. One enables IRQ sharing which must be set if two serial ports are using the same IRQ. The other enables the game port.

The results produced by WaCp.exe are fully integrated with other components of the WaveArtist software set. WaCp.exe writes the options specified by the user to the system.ini file. Both the WaveArtist virtual device driver, vRWAd.386 and SetWaPnp, the DOS configuration utility use the settings in the system.ini file to establish the hardware configuration for the WaveArtist.

Before reading the following lines, there is some temporary hand editing that needs to be done for Windows 3.1 rev 1.62 , rev 1.63, rev 1.7 . However, in the future releases, this will not be necessary. Please open the file named RWAPNPID.inc which is on Disk one of the Windows 3.1 drivers. Inside this file, type in the Rockwell device ID that matches to the PnP EEPROM file that you are using to program the EEPROM on the WaveArtist as outlined by reading the text below. Please refer to Tables 2, 3, 4 in order to decide which value RSS5200 for example you will type into the RWAPNPID.inc file. Then save the file on the floppy and exit out of the text editor, and continue reading the text below.

1. If the WaveArtist drivers are to be installed for WaveArtist card with external 3D spatializer hardware, please read the file called FLEXMIX.doc supplied as a separate document on the diskettes that have the WaveArtist Windows '95 drivers and for reference, read Section 5.5 below, to understand how the 3D spatializer may be enabled in Windows '95 as an example.
2. If the WaveArtist drivers are to be installed for the first time, go to Section 5.2.1.
3. If upgraded WaveArtist drivers are to be installed after a previous installation of WaveArtist drivers, go to Section 5.2.2.
4. If the WaveArtist drivers are to be completely removed, go to Section 5.2.3.

WaveArtist Accelerator Kit User's Guide

5.2.1 Initial Install of WaveArtist Win '3.1 Drivers

1. If the PC does **not** have built-in sound or modem capabilities (i.e., audio or sound device built-in to the motherboard), go to step 4.
2. If the PC has built-in sound (i.e., audio or sound device built-in to the mother board), turn-on the PC and enter CMOS setup; disable any sound support in your BIOS.
3. Save the new settings and exit the CMOS setup. This will take you to the DOS environment. The DOS command line will be displayed. Go to Step 5.
4. Turn on the PC. The DOS environment will be entered. The DOS command line will be displayed.
5. If the EEPROM is **not** to be updated with a revised PnP resource data file supplied on the WaveArtist Win'95 installation diskettes as determined during WaveArtist board hardware installation (see Section 4.1.3), go to Section 5.2.4 to complete the drivers installation.
6. Otherwise, reprogram the EEPROM using the procedure in Section 5.4. Then go to Section 5.2.4 to complete the drivers installation.

5.2.2 Upgrade Install of WaveArtist Win '3.1 Drivers

1. Turn-on the PC. The DOS environment will be entered and the DOS prompt will be displayed.
2. Uninstall the WaveArtist Win '3.1 Drivers using the procedure in Section 5.2.3.
3. Reprogram the EEPROM using the procedure in Section 5.4.
4. Reboot the PC by turning it off, then turning it on (cold boot) from the DOS environment.
5. Upon boot up, enter CMOS Setup, save and exit. (This is necessary for all Compaq Prolinea 5000 series Desktop PCs only. The BIOS remembers which COM port was assigned previously and therefore does not reassign the same port to the newly installed drivers.)
6. Go to Section 5.2.4 to complete the drivers installation.

5.2.3 Uninstall WaveArtist Win '3.1 Drivers

<p>NOTE The following procedure outlined from step 1 through 12 below, applies to WaveArtist Win'3.1 driver releases before revision 1.5 . If you are removing WaveArtist Win'3.1 driver release 1.6 or later, launch the WaveArtist Control Panel (WaCp) through the Windows 3.1 Control Panel window. WaCp will present four buttons in addition to the standard OK and CANCEL buttons. The fourth button is labeled REMOVE. Click this button to remove all Rockwell specific files from your system. You will need to restart Windows 3.1 to complete the removal.</p>

1. Turn the PC on if it is not already on. The DOS environment will be entered and the DOS prompt will be displayed.
2. At the DOS prompt, type WIN and press enter to start Windows 3.1.
3. Go to Control Panel\Drivers\Rockwell WaveArtist. Select and remove it.
4. Go to Control Panel\Drivers\Roland MPU-401. Select and remove it.
5. Go to Control Panel\Rockwell WaveArtist.
6. Click the Rockwell WaveArtist Control Panel\Remove button.
7. Click OK.
8. Go to Program Manager. Select Rockwell WaveArtist icon and delete it by looking under File.
9. You will be prompted to close Windows and restart
10. If you are upgrading the WaveArtist Drivers, answer **No**. Manually close windows. The DOS environment will be entered and the DOS prompt will be displayed.

WaveArtist Accelerator Kit User's Guide

11. If you are completely uninstall the WaveArtist Drivers, answer **Yes** and stop here.
12. Continuing the upgrade, manually, close Windows. The DOS environment will be entered and the DOS prompt will be displayed. Return to the calling procedure.

5.2.4 Common Install of WaveArtist Win '3.1 Drivers

1. At the DOS prompt, type WIN and press enter to start Windows 3.1.
2. Insert the WaveArtist Win '3.1 Driver disk into your floppy drive.
3. From the Program Manager File menu, choose Run.
4. Type the floppy drive letter, then SETUP, e.g., A:\SETUP. The Rockwell WaveArtist screen will appear and the driver software will start loading.
5. The setup procedure presents a dialog box with two command buttons labeled DEFAULT and CUSTOM. Click DEFAULT to accept the default settings for WaveArtist. Click CUSTOM to activate WaCp.exe and specify settings for the WaveArtist devices. Refer to Section 5.2 introduction for a description of WaCp.exe.
6. Proceed through the installation until you see an applet labeled " FINISHED".
7. When prompted to close Windows and restart, answer **Yes**.
8. WaveArtist Win '3.1 Driver installation is complete.

5.3 Installing WaveArtist Drivers in DOS Environment

When operating in DOS, the WaveArtist board emulates the Creative Labs Sound Blaster hardware. This allows you to use any DOS applications that were written for the Sound Blaster Pro. Note that Sound Blaster Pro uses address 220 and 240; address 260 is an invalid address. You should not have to modify the default settings of the I/O Address, Interrupt and DMA channel. However, the ability to do so, is there in DOS.

1. If you have installed your card in Windows 3.1, you will not have automatic support for the joystick or modem. You must run the SETWAPNP utility first in order to use the Joystick, modem and CD-ROM in DOS (Section 5.3.1). The DOS environment settings are reset to Windows 3.1 settings once you leave DOS. When you close Windows 3.1, the DOS settings will be as those set by Windows 3.1 until you change them using SETWAPNP. Therefore, any changes in DOS will not affect Windows settings. Any changes in Windows will affect DOS settings. DOS shells opened from Windows 3.1 will use the settings set by Windows 3.1.

NOTE As of the WaveArtist Win'3.1 revision 1.7 release, the CD-ROM is not supported. The CD-ROM IDE address must be set at boot time before the DOS driver for the CD-ROM drive installs. A DOS installable driver (e.g. a driver loaded through the config.sys file) will be provided in a future release to set the I/O configuration for the CD-ROM IDE interface. A possible work around for this limitation is to use SETWAPNP to set the configuration for the CD-ROM. Then the user must execute a warm boot (i.e., simultaneously press ALT, CTRL and DEL) to restart the system and provide the CD-ROM driver with a defined CD-ROM configuration.

The work around is subject to an additional limitation. SETWAPNP uses the I/O address of 170h for the CD-ROM IDE port. Unfortunately many motherboards now provide two IDE interfaces. The second IDE interface uses the I/O address of 170h. Consequently activating the CD_ROM I/O address through SETWAPNP is likely to result in a plug and play resource conflict.

2. At the A:> prompt, type SETWAPNP /?. This will show you all of the choices in setting up the modem, joystick, CD-ROM, etc. Since the CD-ROM data interface has been disabled in the PnP EEPROM, you must program the PnP EEPROM with the appropriate PnP resource file in order to enable the CD-ROM data interface (see Section 5.4). There is also a Rockwell PRO utility available from your local Rockwell Semiconductor Systems sales office, to generate a new PnP resource data file. The defaults for SETWAPNP are to have CD-ROM disabled.

NOTE If you choose to specify an I/O address for the CD-ROM, we recommend that you avoid using the primary and secondary addresses of 1F0h and 170h since these are likely to cause a conflict. Most CD-ROM drivers check up to four possible I/O addresses for the presence of the CD-ROM drive. The addresses checked after 1F0h and 170h vary with drivers. The specific addresses checked are CD-ROM drive/driver dependent. Programming the IDE interface with a non-conflicting address that the CD-ROM driver does not expect will result in a non-functioning CD-ROM. Additionally the CD-ROM is still subject to the limitation described in the note following item 1 above.

5.3.1 WaveArtist PnP Configuration Utility (SetWaPnp)

In general, SetWaPnp command first looks in system.ini to determine what options to use. If the options are unspecified in the system.ini file, and no command line options are used, SetWaPnp will use the default options defined herein. Command line options override the system.ini specifications if any.

The following description applies to "Set WaveArtist PnP Configuration Utility, V2.2, 10/09/96".

5.3.1.1 Command Syntax

The SetWaPnp.exe command line syntax is:

```
SetWaPnp [options] [/?]/[help] <cr>
```

WaveArtist Accelerator Kit User's Guide

Where the options are described below. Note that the brief form of the following text is displayed by SetWaPnp when the /? and /help switches are added to the command line:

5.3.1.2 Command Options

- /D Displays the configuration before setting the new resources. This option allows the user to see a "before" and "after" display of the changes made to the WaveArtist settings.
- /DO Displays the current configuration without changing it. This option reads the current PnP assignments and displays them. It does not change the settings (DO means Display Only).
- /lxx Specifies the IRQ for the Sound Blaster interface (xx must be 5, 7, or 10; default=7). This option sets the IRQ number to use for the SoundBlaster.
- MDM Disables the modem. This option disables the modem by setting its I/O address to 0 in the PnP configuration register.
- /COM1 Assigns the modem to port 3F8h, IRQ 4. This option assigns the modem I/O address to 3F8h, the address normally associated with COM1 if this address is not already in use by the BIOS. By convention, IRQ 4 is assigned with 3F8h.
- /COM2 Assigns the modem to port 2F8h, IRQ 3. This option assigns the modem I/O address to 2F8h, the address normally associated with COM2 if this address is not already in use by the BIOS. By convention, IRQ 3 is assigned with 2F8h.
- /COM3 Assigns the modem to port 3E8h, IRQ 4. This option assigns the modem I/O address to 3F8h, the address normally associated with COM3 if this address is not already in use by the BIOS. By convention, IRQ 4 is assigned with 3E8h.
- /COM4 Assigns the modem to port 2E8h, IRQ 3. This option assigns the modem I/O address to 2E8h, the address normally associated with COM4 if this address is not already in use by the BIOS. By convention, IRQ 3 is assigned with 2E8h.

5.3.1.3 Order of Precedence for Com Port Specifications

SETWAPNP searches the system.ini file for a specification of the com port assignments for the WaveArtist modem. If no system.ini specifications exist, SETWAPNP then searches for the next available serial port slot in the BIOS com list. Command line options override the system.ini file and the BIOS com list unless SETWAPNP detects a conflict with an existing BIOS com port.

- +CDR Enables CD-ROM IDE ports. This option enables the IDE port at 170h and 376h. This address is most likely to cause conflicts unless the motherboard does not have a secondary IDE interface. We are working on fixing this as well.
- CDR Disables CD-ROM IDE ports (default). This option disables the CD-ROM by setting the PNP configuration registers to 0. This is the default option if the CDR switch is omitted.
- +JOY Enables game port. This option enables the game port at 201h. This address is most likely to cause conflicts unless the system does not already have a game port.
- JOY Disables game port (default). This option disables the game port by setting the PNP configuration registers to 0. This is the default option if the JOY switch is omitted.
- +MPU Enables MPU-401 at port 300h. The default is to enable MPU-401 at port 330h. This option changes the I/O address for the MPU-401 (MIDI port) from 330h to 300h. Otherwise the MPU-401 is normally assigned the address 330h.
- MPU Disables the MPU-401. This option disables the MPU-401 port by setting the PNP configuration registers to 0.
- /Mix Specifies the IRQ for the MPU-401 port (x must be 5, 7, 9, or 10; default=9). This option sets the IRQ number to use for the MPU-401 port. The default is to use IRQ 9 if this switch is omitted.
- /CLR Clears the WaveArtist PnP configuration. This option resets the PnP configuration for WaveArtist by setting all configuration registers to zero.

5.4 Programming the PnP Resource Data EEPROM

The following procedure is normally used to program the PnP EEPROM during a WaveArtist Driver install and upgrade procedure that refers to this section. However, the procedure may also be used separately to configure the WaveArtist hardware in accordance a selected *.txt files (see Table 2 and Table 3).

1. Ensure that the WaveArtist Win'95 installation diskette is inserted into your floppy disk drive.
2. In DOS or in a DOS box (Windows 95 or Windows 3.1), type: **A: <enter>** (where A = the letter of the floppy disk drive).
3. Type **EEPROG Filename**, where **Filename** depends on the configuration of the WaveArtist board and the installed WaveArtist device (see Table 2 and Table 3 for Win'95 Ver 2.32 and above). Press <enter>.
4. A message similar to the following is displayed:

```
WaveArtist PnP EEPROM Programming Utility
      Version V1.31  10/16/96
WaveArtist found.
Data file information:
Data file does not have conversion version or date information.
Proceed with programming (Y/N)?
```

5. Press **Y**. The following is displayed as the programming and verification is performed:

```
Total bytes programmed = XXX      (Note: Maximum = 256)
Verifying..
Total bytes verified) = XXX      (Note: Maximum = 256)
All data verified OK.
```

6. The DOS prompt is displayed upon completion.
7. Return to the calling procedure.

WaveArtist Accelerator Kit User's Guide

Table 2. WaveArtist Device Type Identification

Marketing Number	Manufacturing Number	Type of ISA Bus Decoding
RWA010	R6711-31,-31P,-31PX	16-bit
RWA010	R6711-11,-11P	10-bit
RWA011	R6711-21,-21P	10-bit
RWA100	R7129-21	16-bit
RWA100 Prototype	R7129-11,-11PX,-11PN,-11P	
RWA300	R7127-31,-31PX	16-bit
RWA300 Prototype	R7127-21,-21P,-21PX,-21PN	
RWA300 Prototype	R7127-01P,-11P,-11P2	10-bit
Notes:		
1. If the above parts are used on an audio-only board, use the .txt files with the "A" at the end of the file name, e.g., WA10RESA.		

Table 3. PnP Resource File versus Configuration

File Name	Product Vendor ID	Configuration
WA16A.TXT	RSS5000	16-bit decode audio only
WA16AM.TXT	RSS5100	16-bit decode audio with modem no CDROM
WA16AC.TXT	RSS5400	16-bit decode audio with CDROM no modem
WA16AMC.TXT	RSS5500	16-bit decode audio with modem and CDROM
WA16AS.TXT	RSS5B00	16-bit decode audio with hardware 3D
WA16AMS.TXT	RSS5A00	16-bit decode audio with modem and hardware 3D
WA10A.TXT	RSS5300	10-bit decode audio only
WA10AM.TXT	RSS5200	10-bit decode audio with modem and no CDROM
WA10AC.TXT	RSS5600	10-bit decode audio with CDROM no modem
WA10AMC.TXT	RSS5700	10-bit decode audio with modem and CDROM
WA10AS.TXT	RSS5900	10-bit decode audio with hardware 3D
WA10AMS.TXT	RSS5800	10-bit decode audio with modem and hardware 3D

WaveArtist Accelerator Kit User's Guide

Table 4. Accelerator Kit PnP Resource File Usage (Win'95 Ver 2.33 and Above)

Board Part Number	WaveArtist Device Set	Modem	ISA Bus	CDROM	Resource File
AK28-D640-051 AK28-D640-061 AK28-D640-071 AK34-D220-001 AK34-D230-001 AK34-D240-001	RWA300/RWA100	Yes	16-Bit PnP	Yes	WA16AMC.TXT or WA16AM.TXT
TJ56-D680-003 AK28-D680-031 AK28-D680-051 AK28-D680-061 AK34-D160-001 AK34-D170-001 AK34-D180-001	RWA010	Yes	16-Bit PnP	No	WA16AM.TXT
AK28-D680-041	RWA011	Yes	10-Bit PnP	Yes	WA10AMC.TXT
AK30-D100-021	RWA300/RWA100	No	16-Bit PnP	No	WA16A.TXT
AK30-D110-021	RWA010/RWA030	No	16-Bit PnP	No	WA16A.TXT
AK30-D190-001 / -011	RWA011/RWA030	No	10-Bit PnP	Yes	WA10AC.TXT
<p>Notes:</p> <ol style="list-style-type: none"> 1. PnP resource files are available for WaveArtist boards supporting audio only, audio plus modem, audio plus modem plus CD-ROM, and audio plus CD-ROM, for both 10bit and 16bit decoding. The naming convention is "m" for modem, "c" for "CD" and "a" for audio. For example, the file WA16AMC.TXT is the resource data for the version supporting audio, modem, and CD. Customers should use these files as templates. To know if your board has 10-bit or 16-bit parts please refer to Error! Not a valid result for table.. 					

5.5 External 3D Spatialization Hardware Designs

Please read this section and then return to section 5.1 for installation procedures. There are currently two different reference designs that incorporate external circuitry for implementing the 3D Spatialization effect in hardware:

Design 1: intended for cards without an IDE (CD-ROM) interface.

Design 2: intended for cards with the IDE interface.

Design 1:

- Requires one of the resource files: WA16AS.TXT, WA16AMS.TXT, WA10AS.TXT, or WA10AMS.TXT (for a description of these files see section 5.4).
- Creates a “**Hardware 3D Spatializer Port**” logical device.

Design 2:

- Requires one of the resource files: WA16AC.TXT, WA16AMC.TXT, WA10AC.TXT, or WA10AMC.TXT (for a description of these files see section 5.4).
- Will **not** create a special logical device: resources are supplied within the “**WaveArtist IDE Interface**” logical device.

Editing the INF File

WaveArtist Accelerator Kit User's Guide

The file rwa95.inf that is supplied on the WaveArtist driver files will require editing to indicate which type of 3D hardware design to support. The following sections of comments are taken from file 'rwa95.inf' in order to show what needs to be edited using a text editor prior to installing the WaveArtist card:

```
; 2. OEMs wishing to change the support options for Hardware 3D (Analog Spatializer)
; should go to the [RSS5002.AddReg] section of this file and uncomment
; the appropriate add registry line for the Hardware3D symbol.
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
;;; OEM Selectable Hardware 3D Option
;;;
;;; NOTE: The entry OptHardware3D (below) should be edited to match the OEMs hardware.
;;; The "0" option (default) indicates no special 3D circuitry has been added by the
;;; OEM. The "1" option, indicates that the base address of the first IO Address range
;;; for WaveArtist logical device #3 (IDE) should be used as a write only location in Bit
;;; 7, to enable/disable the OEM added 3D circuitry. The "2" option indicates that the 2nd
;;; IO address range of this logical device should be used as the (bit 7) output 3D enable
;;; port.
;;; Note that for systems which support both a WaveArtist IDE and the 3D, that "2" should
;;; be used because it is not used in normal IDE operation.
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;

;-----Uncomment one and only one of the following 3 lines! -----
HKR,Config,OptHardware3D,1,00
;HKR,Config,OptHardware3D,1,01
;HKR,Config,OptHardware3D,1,02
;-----Uncomment one and only one of the previous 3 lines! -----
```

Examples:

- Cards without an IDE (CD-ROM) interface and no support for external 3D.

```
HKR,Config,OptHardware3D,1,00
;HKR,Config,OptHardware3D,1,01
;HKR,Config,OptHardware3D,1,02
```

- Cards without an IDE (CD-ROM) interface and support for external 3D:

```
;HKR,Config,OptHardware3D,1,00
HKR,Config,OptHardware3D,1,01
;HKR,Config,OptHardware3D,1,02
```

- Cards with IDE (CD_ROM) interface and support for external 3D:

```
;HKR,Config,OptHardware3D,1,00
;HKR,Config,OptHardware3D,1,01
HKR,Config,OptHardware3D,1,02
```

6. WINDOWS 95 APPLICATIONS

6.1 OPERATING THE WAVEARTIST MIXER

6.1.1 Playback Controls

1. Choose **Start\Programs\Accessories\Multimedia\Volume Control** or double-click on the **Speaker** icon located at the lower right corner of the screen.
2. In the **Volume Control** box, in the **Options** menu, click **Properties**. In the **Properties** box, click **Playback**. The **Playback** box will appear. The playback channels are described in Table 5.

NOTE The Line-in and Microphone inputs default to off (**Mute** checked).

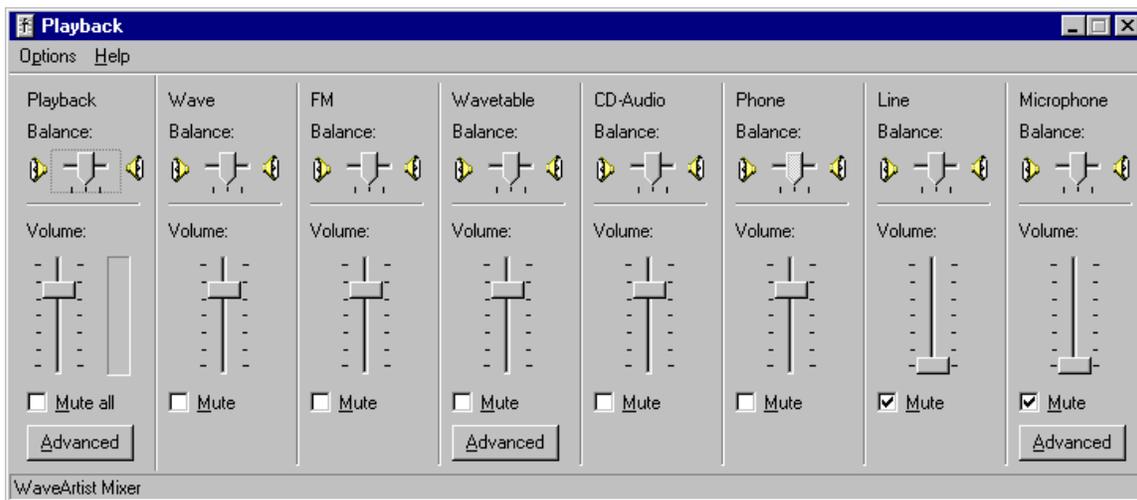


Table 5. Volume Control - Playback Option

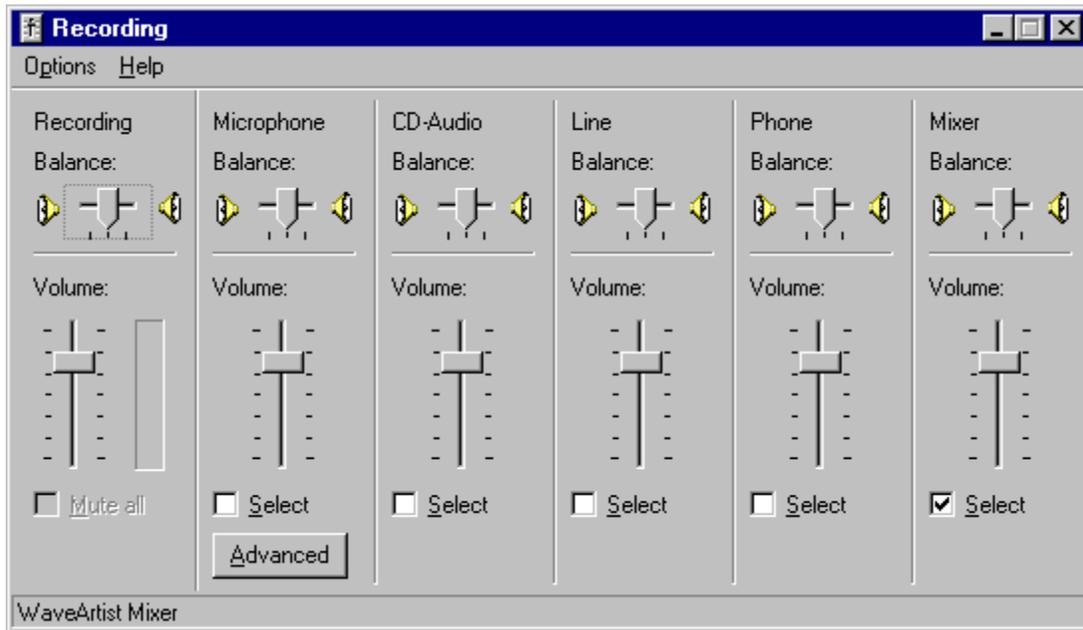
Channel Name	Description	Analog	Digital	Advanced Controls	Mode
Playback	The Master Volume control for both the Line Output and Headset Output.	x	x	Note 1	Stereo
Wave	PCM Playback.		x		Stereo
FM	FM Synthesizer.		x		Stereo
Wavetable	Wavetable Synthesizer.		x	Note 2	Stereo
CD-Audio	The audio coming from the CD-ROM drive. This is usually from the 4-pin header on the board.	x			Stereo
Line Input	Controls the volume of the Line-input jack on the rear panel	x			Stereo
Phone	This is all of the audio coming from the modem. Typical applications are the speakerphone and CPM (Call progress monitoring). This signal is mono and heard in both left and right outputs.	x			Mono
Microphone	The microphone signal is monaural but goes to both channels.	x		Note 3	Mono

NOTES

1. Controls Treble, Base and 3D processing for playback only. These effects will not be part of a recording.
2. Selects whether the synthesizer Wavetable, Reverb, or Chorus mode.
3. Provides the option for a 20dB boost on the microphone input.

6.1.2 Recording Controls

1. Choose **Start\Programs\Accessories\Multimedia\Volume Control** or double-click on the **Speaker** icon located at the right corner of the taskbar.
2. In the **Volume Control** box, in the **Options** menu, click **Properties**. In the **Properties** box, click **Recording**. The **Recording** box will appear. The recording channels are described in Table 5.



Recording Controls

Channel Name	Description	Analog	Digital	Advanced Controls	Mode
Recording	Recording Master Volume Control.	x		Note 4	Note 6
Microphone	Microphone is only connected to the left channel. If you record a stereo wave file, the right channel will be muted.	x			Mono
Line Input	The Line-input jack on the rear panel.	x			Stereo
CD-Audio	The audio coming from the CD-ROM drive. This is usually from the 4-pin header on the board.	x			Stereo
Phone	Has signals from playback phone as well as outgoing microphone. See Note 5.	x			Note 5
Mixer	The output of the playback mixer. This is the only way to record from the Wave, FM, and Wavetable channels. This is also the only way to record two inputs simultaneously.	x			Stereo

NOTES

1. Provides a boost for incoming signals just before the ADC stage. It does not affect playback.
2. Recording from the phone can be done in two ways:
3. If you want to record only what is coming from the modem, i.e., recording a handset conversation.
 - a) If you are recording the speakerphone, the left channel records your voice (after echo cancellation) while the right channel records incoming voice; **therefore you must record a stereo file.**
 - b) If recording a mono wave file, it will default to left channel except the "Phone" channel, see note 5.

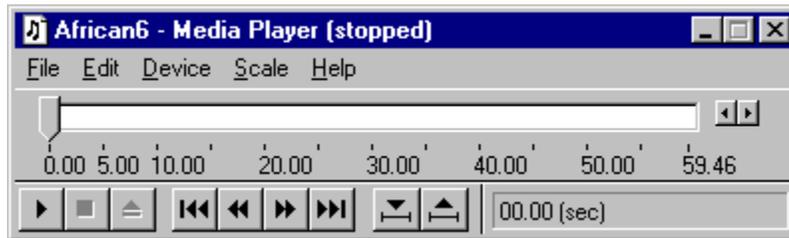
6.2 AUDIO

The audio functionality of the WaveArtist Reference Board can be demonstrated by using the Multimedia Application. By invoking the Multimedia Media Player and Mixer Volume Controls you can do the following:

- **Play digital (PCM) wave files.**
- **Play MIDI (FM or Wavetable) music files.**
- **Play audio CD tracks of your favorite artists.**
- **Add 3D sound and special effects such as reverb, chorus, treble and bass.**
- **Record your own voice or any external sources from CD Player, Microphone, MIDI keyboard...**
- **Create custom collections of your favorite music and sounds.**

6.2.1.1 Playing a Sound Wave File (.WAV)

1. Choose **Start\Programs\Accessories\Multimedia\Media Player**.



4. In the **Media Player** dialog box, on the **Device** menu, select **Sound**.
5. In the **Open** dialog box, enter the folder name that contains the wave file and double-click the wave file name.
6. In the **Media Player** dialog box, click **Play**.
7. To add 3D sound and effects to the wave file, in the **Media Player** dialog box, on the **Device** menu, choose **Volume Control**.
8. In the **Volume Control** dialog box, click **Advanced** under Playback.

WaveArtist Accelerator Kit User's Guide



4. In the **Advanced Controls for Playback** dialog box, click the **3D** box. Position yourself midway between the speakers. You should hear the sound becoming louder and panning left or right.
5. In the **Advanced Controls for Playback** dialog box, adjust the **Treble** and **Bass** by moving the corresponding slider to the right and left and notice the treble and bass changes.

6.2.1.2 Playing a MIDI File

1. Choose **Start\Programs\Accessories\Multimedia\Media Player**.
2. In the **Media Player** dialog box, on the **Device** menu, select **MIDI Sequencer**.
3. In the **Open** dialog box, enter the folder name that contains the MIDI files and double-click a MIDI file name.
4. In the **MIDI Properties dialog box**, select **WaveArtist MPU-401** if you want to hear wavetable sound or select **WaveArtist FM** if you want to hear FM sound. Click **OK**.
5. In the **Media Player** dialog box, click **Play**.
6. Try 3D sound and effects as for the wavetable files.

6.2.1.3 Playing CD Audio

1. Insert a CD audio compact disk into your CD-ROM drive. The CD player should appear on your screen and begins playing music. If not, choose **Start\Programs\Accessories\Multimedia\CD Player**.



3. In the **CD Player** dialog box, select the artist and track, then click the **Play** button.

NOTE You cannot play 3D sound or add any effects to the CD audio because the CD audio signals only playback through the analog loopback mixer. To hear 3D and special effects, you must record it to a file first, then play it back.

6.2.1.4 Recording a Wave File (.WAV)

1. Choose **Start\Programs\Accessories\Multimedia\Sound Recorder**.



1. In the **Sound - Sound Recorder** dialog box, in the **File** menu, select **Properties**.
2. In the **Properties for Sound** dialog box, click **Convert Now**.
3. In the **Sound Selection** dialog box, choose the type of audio format, i.e., CD Quality, Radio Quality, and Telephone Quality in the **Name** box, or change the sampling rate in the **Attributes** box. Click **OK**.
4. Double-click the speaker icon in the lower right hand-corner of the screen, or choose **Start\Programs\Accessories\Multimedia Volume Control**.
5. In the **Volume Control** window, on the **Options** menu, select **Properties**.

WaveArtist Accelerator Kit User's Guide

6. In the **Properties** dialog box, click **Recording**, Select the type of input source for the Recording Controls. Click **OK**.

NOTE	The inputs choices are:
Microphone	Typically a Telex or a Plantronic microphone. The microphone gain can be boosted to +20 dB by clicking Advanced under the Microphone column and selecting Microphone box. Deselecting it will have 0dB gain.
Line-in	The source is typically from a CD player.
CD-Audio In	The audio signals coming from a CD-ROM drive via 4-pin CD-Audio connector.

8. In the **Recording Control** box, adjust the **Volume** and **Balance** sliders for the selected input.

6.2.1.5 Multi-Sources Recording

The WaveArtist board recording with multiple inputs.

1. In the **Recording** dialog box, Click on **Mixer** box under Recording Controls.
2. Mix signals from available audio sources as desired.

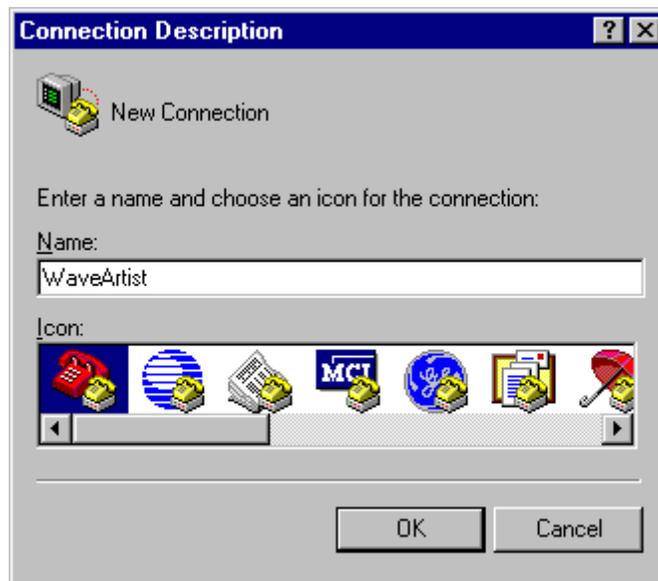
6.3 MODEM

After installing the WaveArtist drivers, you are now ready to make a connection with remote computer. The modem functionality can be demonstrated by using the communication software (ProComm Plus, QuickLink, etc....) or the Windows Hyper Terminal. For the purpose of this exercise, we will use Hyper Terminal emulation. By invoking the Hyper Terminal folder, you can do all of the following:

- **Playback of voice messages through telephone line and speaker output.**
- **Simultaneous voice and data (SVD) with handset, full-duplex speakerphone, or headset over a single telephone line using SVD-compatible modems.**
- **Record your personal messages through handset or microphone.**
- **Record conversation.**
- **Connect to remote computer.**

6.3.1 Using HyperTerminal to Test the Modem

1. Choose **Start\Programs\Accessories\HyperTerminal**.
2. In the **HyperTerminal** dialog box, Click on **Hyperterm** icon (Hyperterm.exe).

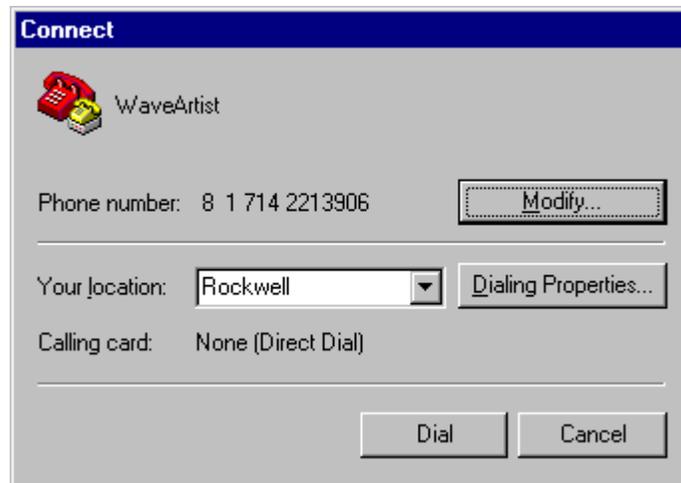


3. In the **Connection Description** dialog box, enter **WaveArtist**. Click **OK**.

WaveArtist Accelerator Kit User's Guide

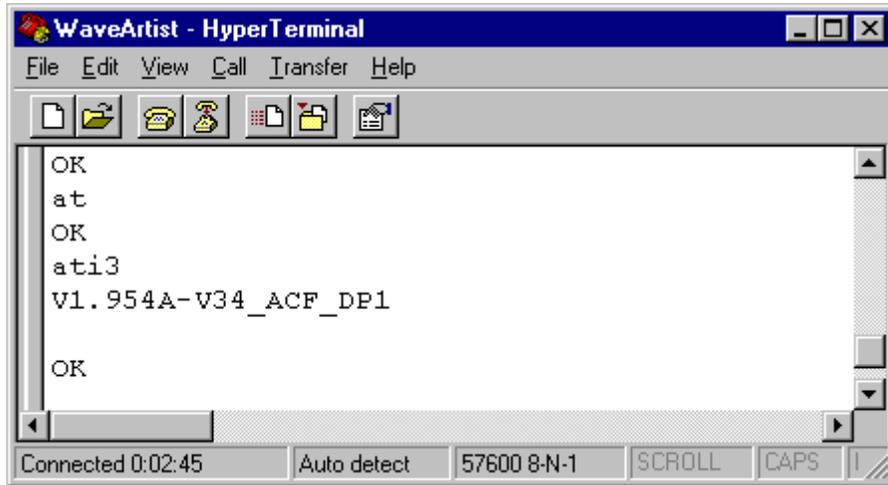


4. In the **Phone Number** dialog box, Enter the area code **714** and telephone number **2213906** (for example) that you want to dial to. Click **OK**.

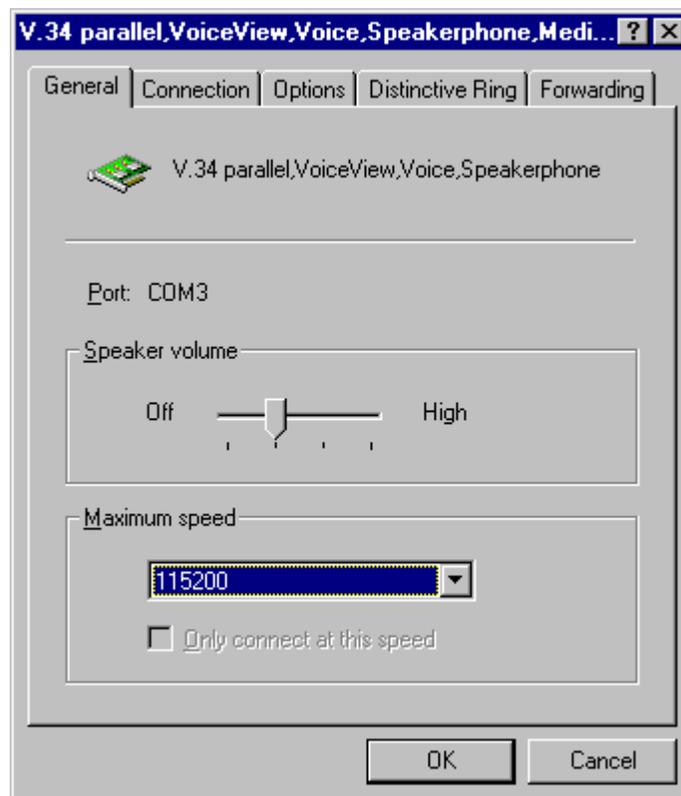


5. You can click **Dial** to initiate dialing or **Cancel** to terminate the connection. If you click **Cancel**, HyperTerminal will display a blank terminal window as shown below.

WaveArtist Accelerator Kit User's Guide



6. You can now enter the AT command, e.g., type **AT** <enter>. The modem will respond with OK. This will indicate that the modem is talking to the host computer (but does not indicate that the modem is attempting to establish a telephone line connection).
7. In the WaveArtist HyperTerminal dialog box, in the File menu, select **Properties**.
8. In the **Properties** dialog box, Click **Configure**.
9. In the **Configure** dialog box, select the **General** tab.
10. In the **General** tab box, select the modem Maximum speed by clicking on the arrow button. Click **OK**. Now you are ready to place a telephone call in order to command the modem to made a telephone line connection.



WaveArtist Accelerator Kit User's Guide

11. To dial, enter **ATDTnnnnnnn** or **ATDPnnnnnnnn**, where **nnnnnnn** is the phone number of a remote modem (try calling a local Bulletin Board Service or BBS). Use **ATDT** if you have a touch tone line and **ATDP** if you use a pulse dial line. You should hear some high pitched tones then something that sounds like static after the remote modem picks up your call. If the call progress went smoothly, you should see **CONNECT** on your terminal. You can send data to the remote modem by sending characters via your keyboard. If you are calling a BBS, pressing carriage return will usually prompt the BBS to respond with a greetings message and a login message.
12. After you have finished your session with the remote modem, you may want to hang up (if the remote modem doesn't hang you up automatically). To hang up, type in three plus signs **"+++"** in a row (delay less than one second between characters) to get to the AT command mode and you should see **"OK"**. Then type in **ATH** and your modem should hang up the connection. You may dial another modem by repeating this section.

7. Audio Enhancements

7.1 RWA035 Effects Patches for 256K DRAM

Effects patches are to be generated into .MAL files for RWA035. Rockwell will supply the .MAL files set which will include the 256K DRAM delay line clearing algorithm patch and the rest of the effects patches organized into separate .MAL files.

The WaveArtist drivers will be updated to detect the 256K or 64K DRAM so that appropriate patch files can be downloaded. This will be accomplished via an entry in the .INF file to indicate which DRAM is present on the board.

The conversion of the .MAL files to SYSEX commands for the standalone waveblaster daughter card configuration, may be done manually and will also be available.

7.2 Serial Wave Device vs Wave Wrapper Device

At the time the WaveArtist drivers are installed, there must be one MODEM.INF and one MODEMAUD.INF on the installation diskettes. These will either be the original files (for Serial Wave) as originally supplied or the copied .WRP files, for Wave Wrapper, as described below.

The default for the modem and wave audio drivers is the Serial Wave device, as previous driver releases. The files MODEM.INF and MODEMAUD.INF in the release set will default to support this (Serial Wave).

The user can alternatively choose to install the "Wave Wrapper" device instead of the Serial Wave device. They cannot coexist. To do this, the customer must, before installing WaveArtist, rename the new files MODEM.WRP and MODEMAUD.WRP to MODEM.INF and MODEMAUD.INF respectively, replacing the default ones with the "Wave Wrapper" files. Then, when the user installs the drivers, he will get Wave Wrapper instead of Serial Wave. Thus the file extension "WRP" stands for "Wave Wrapper." Each of these INF files create specific registry settings that setup the system for either Serial Wave, or Wave Wrapper.

Serial Wave uses the COM port to play audio through the modem's "Business Audio" feature. The audio data flows through the modem's emulated 16550 UART, without DMA support. The modem codec is employed with a sample rate of 7200Hz.

Wave wrapper, instead issues AT#V commands to properly switch in the modem's MIC_IN and SPEAKER_OUT channels at the right times. The audio data is routed through the standard WaveArtist drivers and hardware utilizing DMA and the superior WaveArtist audio codec, with sample rates of 4 to 44.1 KHz.

7.3 Rockwell SYSEX to adjust Homac decompression filter gain and cut-off frequency

SYSEX format:

```
F0 00 01 03 00 00 00 01 1C 01 00 aa bb cc F7
```

where aa bb cc represent a 13 bit Homac decompression filter coefficient (HDFC) plus zero filling bits to make up 21 bits or 3 SYSEX data bytes. The following is the break down of the bits.

Homac decompression coefficient (13 bits)

Bits 0 to 4 are Ps which sets the pole of the filter. Default value is 8 (approx. 25Hz). Decreasing Ps

WaveArtist Accelerator Kit User's Guide

increases the cut-off frequency which makes the sound brighter.

Bits 5 to 9 are As which sets the scaling number of right shifts. Decreasing As increases the gain.

Bits 10 to 12 are Ls which sets the scaling number of left shifts. Increasing Ls increases the gain.

aa

Bits 0 to 3 are always 0.

Bits 4 to 6 are the 3 LSBs of the Ps..

bb

Bits 0 and 1 are the next higher two bits of the Ps.

Bits 2 to 6 are the bits for As.

cc

Bits 0 to 2 are the bits for Ls.

Bits 3 to 6 are always 0.

Example:

The default setting of the HDFC is 0028 (hex). This translate to the following SYSEX

```
F0 00 01 03 00 00 00 01 1C 01 00 00 05 00 F7
```

HDFC = 0026 which is slightly brighter than 0028 then SYSEX is

```
F0 00 01 03 00 00 00 01 1C 01 00 60 04 00 F7
```

7.4 Creating Custom Patches and Samples for the WaveArtist RWA030

Suggestion #1:

Tweak the existing values that make up the patches in the ROM-coded GM set. (easiest)

How this works:

A 64KB or bigger RAM must be attached to the RWA030. The device driver will need to copy the segment of the database that contains all of the parametric data into the RAM. From there, SysEx commands can tweak existing values, like envelope shapes, filter cutoffs, LFO frequency/amount, sample mappings, etc. In effect the user would be "customizing" the GM set to his or her liking. The standard mechanism for selecting GM instruments (program changes) will still be the only relevant factor, just the resulting instruments will be different.

Effort required:

The MPU-401 driver will need modification to perform the copying of the parametric data. Additionally, it will need to force the engine to look at the RAM database instead of the ROM version. Some MIDI snooping may be necessary to keep the synthesizer properly pointed to the RAM database. Someone will need to develop an application that understands the sound parameters well enough to diddle the right bytes using SysEx. We do have enough information to guide your efforts on how

WaveArtist Accelerator Kit User's Guide

things work now. However, we don't have wonderful documentation on what all the possibilities are. Bugging Kurzweil will be necessary if you want to do anything out of the ordinary.

Suggestion #2:

Allow for full manipulation of all aspects of the synth architecture using the existing ROM-based samples. (moderately difficult)

How this works:

Same as above except now the application needs to really understand the intricacies of the object-style modules of the patch architecture. Unlike the ICS synth you worked with previously, the KTG way of encoding patch data does not use fixed-size structures. KTG uses what they call "objects" which may contain a LFO modulator, function generator, envelope, etc. The more complicated the instrument, the more modulators involved. They are linked together using pointers.

Effort required:

The editing application will be more work. This is where we have less information than we would like. Working with KTG would most likely be necessary.

Suggestion #3:

Provide full flexibility in sample creation, downloading, and editing. (difficult)

How this works:

Same as the above with the addition of a sample editing control panel that would download the new PCM.

Effort required:

You would need another application which I believe is part of TB's capability, a sample editor. But, the synth uses a proprietary compression that we presently do not understand. Cooperation with KTG is essential here. Downloading the sample data would require programming on your part.

7.5 To produce a CD-ROM for the two diskette WaveArtist Windows '3.1 Drivers

Method 1:

Create two directories on the CD-ROM and label them as "disk1" and "disk2". Then put the appropriate files from each diskette into these directories. It doesn't matter in this case what the CD-ROM 'label' actually is.

Method 2:

In order to have one directory on a CD-ROM that contains all of the files necessary to install the WaveArtist Windows 3.x drivers you can do the following. Edit the compressed file called "rwasetup.in_" on disk1 after uncompressing it to a file named "rwasetup.inf". To uncompress, copy the compressed file to a hard disk, then use the command: "expand rwasetup.in_ rwasetup.inf" to uncompress it. The second and third lines of the uncompressed file contain the following in the order written:

```
"disk number", "NAME to call the disk when asking for it", "a file on the disk",  
"the PATH to the files":
```

WaveArtist Accelerator Kit User's Guide

The contents of the second and third line are :

```
"1", "Disk 1", "vb40016.dl_", "..\disk1"  
"2", "Disk 2", "oc25.dl_", "..\disk2"
```

You can most easily make both NAMES and PATHS the same, and then all of the files will be looked for in the same directory when installing. The path "." might work in this case. You may try this in order to make sure it works. You will NOT get a 'change disk' message when the same directory is used.

Method 3:

Complete Method 2 as outlined above. Continue to edit the "rwasetup.inf" file by going down all of the other lines in the file, and change those lines that start with "2", to "1",. You can then remove the whole line that refers to " Disk 2" entirely. This would be line three in the rwasetup.inf file as shown above. But there's no real need to do this since Method 2 above, completes the job.

To Close:

After making the above change, use the command: `compress rwasetup.inf rwasetup.in_` to recompress the file. Then copy the new file back to the "Disk 1" directory of the CD-ROM.

8. MODEM OPERATION

8.1 CONFIGURING THE COMMUNICATIONS SOFTWARE

After configuring and installing a WaveArtist combo card, you are now ready to make a connection with another modem.

1. Load (or install) your communications program (such as CROSSTALK or ProComm Plus) into your PC.
2. If the modem is used as a data modem, configure the communications parameters of the program (set COM level, DTE speed, data, word length, parity, and number of stop bits) to match that of the data modem that you are calling. Typical parameters could be 38400 bps DTE speed, no parity, 8 data bits, and 1 stop bit. Refer to the software communications manual on setting parameters.

8.2 OPERATING THE COMMUNICATIONS SOFTWARE

You can either follow the instructions of the communications program manual or use "AT" commands to operate the modem. The first method is useful for transferring files, receiving files, periodic dialing, and performing other functions supported by your communications program; stop here and refer to your communications program for this method. The second method gives the user direct control of the modem but requires someone who is knowledgeable on "AT" commands.

8.2.1 Manual Operation using AT Commands

1. Invoke the terminal mode in your communications package.
2. Enter **AT** and make sure that "OK" is returned. Enter **AT&F** to reset modem configurations to default values. All instructions to the modem are communicated through AT commands. For example, **ATD** is the AT command for the modem to dial; all AT commands start with the "AT" characters. Refer to the RC336ACF/SP Modem Designer's Guide for the list and descriptions of the AT commands that the WaveArtist board target board supports.
3. To dial, enter **ATDTnnnnnnnn** or **ATDPnnnnnnnn**, where **nnnnnnnn** is the phone number of a remote modem (try calling a local Bulletin Board Service or BBS). Use **ATDT** if you have a touch tone line and **ATDP** if you use a pulse dial line.
4. You should hear some high pitched tones then something that sounds like static after the remote modem picks up your call. If the call progress went smoothly, you should see CONNECT on your terminal. You can send data to the remote modem by sending characters via your keyboard. If you are calling a BBS, pressing carriage return will usually prompt the BBS to respond with a greetings message and a login message.
5. After you have finished your session with the remote modem, you may want to hang up (if the remote modem doesn't hang you up automatically). To hang up, type in three plus signs "+++" in a row (delay less than one second between characters) to get to the AT command mode and you should see "OK". Then type in **ATH** and your modem should hang up the connection. You may dial another modem by repeating this section.

8.3 OPERATION IN FAX MODE

The WaveArtist board Reference Board is compatible with a wide variety of fax Class 1 and Class 2 communications software. Please refer to your local Rockwell Field Applications Engineer for an up to date list of compatible packages and their version numbers.

Refer to your fax communications software to configure the modem to send or receive fax transmissions.

8.4 OPERATION IN VOICE MODE

Voice/Audio mode operation of the WaveArtist Reference Board may be demonstrated by using the A-Voice-Note Voice Annotation Software supplied with this design. Commercial voice software is available from independent vendors, please refer to your local Rockwell Field Applications Engineer for a current list of compatible packages and their version numbers.

8.5 EXTENSION PICKUP OPERATION

Presently the WaveArtist boards are not populated with the Extension Pickup components. This operation functions when the modem is acting as a Telephone Answering Machine (TAM) with the use of an application whereby the remote party dials in, the modem answers and starts recording the remote party's message. If the local person happens to pick up a handset of another phone with the same phone extension locally, the modem will detect the pick up of the handset and will stop the recording of the remote message. The modem knows that the handset has been lifted because it can measure the loop current.

Another situation whereby the modem may discontinue the recording of the remote party's message is when the remote person hangs up at the end of his message. The local modem can detect silence on the line and thereby will stop recording and disconnects itself from the line by going ONHOOK.

In both of the above cases, the modem will echo a message back to the monitor stating which type of disconnect it was: a silence on the line or a drop in loop current. The application will display either message accordingly.

8.6 UPGRADING THE MODEM FIRMWARE WHEN USING FLASH PARTS

If you have a Flash EEPROM for the modem firmware on the WaveArtist card, you may automatically upgrade the firmware in the EEPROM while the card is running in your PC. You will need two files to do this. This first file being the new firmware that is to be programmed into the EEPROM (eg. 2050dp.s37) and the second file being the AMD Flash loader utility (AMDE.s37) . These are obtained from your local Rockwell Field Applications Engineer. Follow the below procedure in order to upgrade the firmware on your exiting, installed, and operating WaveArtist card.

1. With the PC turned on and a WaveArtist card installed properly, go to a Windows'95 DOS box.
2. At the A: prompt in DOS, type : SETWAPNP /COM3 /DO
3. The above will set the modem to a free com port. You may select between com 1 and 4 if you are using Procomm Plus for DOS, in the following step.
4. Open Procomm Plus by typing : PCPLUS
5. Set the DTE speed to 57600 by pressing ALT-P when in the Procomm Plus shell.
6. Type in : AT&F to reset the modem.
7. Type in : AT**2
8. Press the PageUp button on the keyboard to select ASCII file type transfer.
9. Select AMDE.S37 for the filename to download.
10. Once this file has been downloaded, you will be required to press the PageUp button on the keyboard in order to select the new modem firmware that you will use (2050dp.s37).
11. It will take about 30 minutes for the job to complete. Once completed, you may close the DOS box and go back to Windows '95 and enter Hyperterminal or an application software in order to use the modem. You may also continue to use Procomm Plus to in the DOS as well. However, it is recommended to type AT&F after the upgrade is complete in order to reset the modem.

9. TELEPHONY OPERATION

9.1 OPERATION IN SPEAKERPHONE MODE (AT#VLS=6)

Speakerphone mode operation of the WaveArtist evaluation board may be demonstrated by using "AT" commands on commercial telephony software from independent vendors, please refer to your local Rockwell Field Applications Engineer for a current list of compatible packages and their version numbers.

9.1.1 Manual Operation Using "AT" Commands With Windows 95 Hyperterminal and Willow Pond Media Rack Mixer Utility

1. In Windows 95, open the Willow Pond Media Rack "Mixer" utility. To ensure correct speakerphone operation, **disable the playback MIC input (mute) and reduce the MIC slider level to minimum**. These settings will be retained the next time the mixer application is opened. This can also be done with the Windows '95 Mixer applet as well, if you are not using the Willow Pond Media Rack Mixer Utility.
2. Go to the Windows 95 Hyperterminal utility and select the correct communication port that corresponds to the reference board COM port setup. Also, select 19200 bps as the DTE speed.

9.1.2 Originating a Voice Call in Speakerphone Mode

1. Choose **Start\Programs\Accessories\Multimedia\Volume Control** or double-click the **Volume Control icon** on the **Task Bar**. Select **Options\Properties**. In the **Properties** box, select **Recording** and **Microphone**.
2. Invoke the terminal mode in your communications package.
3. Enter **AT** command. The modem will respond with **OK**. **Note:** For all AT commands, press the RETURN key after keying the AT command string to invoke the command.
4. Enter **AT&F** to reset modem configurations to default values. All instructions to the modem are communicated through AT commands. For example, ATD is the AT command for the modem to dial; all AT commands start with the "AT" characters. Refer to the Modem Designer's Guide for a list of the AT commands that the Target Board supports.
5. Enter **AT#CLS=8#VRN=0#VLS=6**. The modem will respond with **OK**. This will initialize the modem for speakerphone mode.
6. To dial, enter **ATDTnnnnnnn** where **nnnnnnn** is the phone number of a remote party. The modem will report **VCON** at the completion of dialing and indicate speakerphone is on.
7. To hang up, enter **ATH**.

9.1.3 Answering a Voice Call in Speakerphone Mode

1. Choose **Start\Programs\Accessories\Multimedia\Volume Control** or double-click the **Volume Control icon** on the **Task Bar**. Select **Options\Properties**. In the **Properties** box, select **Recording** and **Microphone**.
2. Invoke the terminal mode in your communications package.
3. Enter **AT** command. The modem will respond with **OK**. **Note:** For all AT commands, press the RETURN key after keying the AT command string to invoke the command.
4. Enter **AT&F** to reset modem configurations to default values.
5. Enter **AT#CLS=8#VRN=0#VLS=6S0=0**. The modem will respond with **OK**. This will initialize the modem for speakerphone mode.
6. To answer a call in speakerphone mode upon receipt of a **RING** message, enter **ATA**. The modem will report **VCON** to indicate speakerphone is on.
7. To hang up, enter **ATH**.

WaveArtist Accelerator Kit User's Guide

9.1.3.1 AT#SPK Parameter

The setting of the speakerphone may be adjusted with the AT#SPK command:

AT#SPK=<mute>,<spkr>,<mic>

The #SPK command may be used to control the microphone state (mute or on), adjust the speaker volume, and microphone gain. The #SPK parameters are accepted and valid only after the modem has entered the Voice Online (VCON) mode while in the #VLS=6 setting (after a VCON during originate or answer). The modem will respond "ERROR" otherwise. It is recommended that Host Software allow the selection of microphone AGC levels (0-3) and speaker output levels (0-16) using the AT#SPK command.

The Room Monitor Feature will allow the modem to be configured to a listen only mode where the microphone automatic gain control is set to maximum (50dB). In an application, a remote caller calls the computer to monitor what is happening in the local room (AT#SPK=2,,,).

Parameter	Functions	Parameter
<mute>	Microphone mute	0
	Microphone on (default)	1
	Room monitor mode (mic on max AGC, speaker off)	2

Parameter	Speaker Output Level	Value	Attenuation (dB)
<spkr>	Range (speaker attenuation in 2 dB steps)	0 to 15	0 - 30 dB
	Default	5	10 dB
	Speaker mute	16	n/a

Parameter	Microphone AGC Level	Value	AGC (dB)
<mic>	Range 0 to 3	0	0 dB
	Default	1	6 dB
		2	9.5 dB
		3	12 dB

It is not necessary to enter all <mute>,<spkr>,<mic> options while issuing AT#SPK.

For example:

1. To mute the microphone without changing speaker volume, issue AT#SPK=0,,,
2. To change speaker volume to 6 without affecting microphone setting, issue AT#SPK=,6,,
3. To change speaker volume to 6 and microphone gain to 9.5 dB, issue AT#SPK=,6,2,
4. To use the Room Monitor feature, issue AT#SPK=2,,,. This command selects a listen only mode where the microphone AGC is set to maximum and the speaker output is off.

WaveArtist Accelerator Kit User's Guide

Examples:

AT#SPK= <mute>,,	Changes the <mute> setting
AT#SPK = ,<spkr>,	Changes the <spkr> setting
AT#SPK = ,, <mic>	Changes the <mic> setting
AT#SPK = <mute>,<spkr>,,	Changes the <mute> and <spkr> settings
AT#SPK = <mute>,,<mic>	Changes the <mute> and <mic> settings
AT#SPK = ,<spkr>,<mic>	Changes the <spkr> and <mic> settings

9.2 WaveArtist SUPPORT MODES

Sound card support modes are selected in voice mode with the following AT#VLS= commands:

9.2.1 #VLS=7 - Muting the local handset during phone conversation - Music on Hold (Valid after Voice On-line mode)

This command will mute the local handset by switching the handset or speakerphone out of the TELCO path if in #VLS=0 or #VLS=6 mode. To unmute, the host software shall switch to phone line mode (#VLS=0) or speakerphone mode (#VLS=6).

On hardware designs which incorporate the WaveArtist audio codec, #VLS=7 can be used to route the audio codec's output through the phone line via the modem device to provide music-on-hold feature.

9.2.1.1 Music-on Hold Using Window 95 Hyperterminal

1. Establish a call in one of two ways, either the local user picks up handset and dials out and the remote user answers, or the remote user dials in and local user answers by picking up the handset. Both users can hear each other at this point.
2. Select **Start\Programs\Accessories\Hyperterminal**.
3. Issue proper AT commands so that music can be heard by the remote user but the local handset is muted.

```
at&f
OK
```

```
at#cls=8
OK
```

Locally, issue this command to mute local handset .

```
ata
VCON
```

After VCON, both sides can now hear each other.

```
at#vls=7
OK
```

4. Choose **Start\Programs\Accessories\Multimedia\Media Player**. In **Media Player**, open and play a MIDI file or a .WAV file that has been recorded at 8KHz. The central office does not allow more than 8KHz files to be played over the phone lines.

WaveArtist Accelerator Kit User's Guide

9.2.1.2 DTMF Tone Detection Test

To enable DTMF tone detection during music-on-hold mode (so that numbers keyed on the remote phone keypad will appear on the local monitor), enter the following commands (or use ConfigureAce):

1. The remote or local user dials and the other user answers by picking up the handset. They can both hear each other at this point.
2. Issue proper AT commands.

```
at&f
OK
```

```
at!0048M
0048: 46
```

Enter this command. The next line is displayed.

```
0048: 46 06
0049: 8A
OK
```

Type 06 beside the 46 and press the space bar. The next two lines are displayed.

This will enable DTMF tone detection by the modem.

```
at#cls=8
OK
```

Locally we issue these commands, which mutes local handset.

```
ata
VCON
```

After VCON, both sides can now hear each other.

```
at#vls=7
OK
```

Open the media player, play a MIDI file or a .WAV file that has been recorded at 8KHz. The central office does not allow more than 8KHz files to be played over the phone lines.

```
1 3 5 5 8
```

Remote person should press keys as typically shown on the phone, the local monitor should display the keys on the monitor.

When DTMF digits are sent, it is recommended to change the default value of the tone length to 100ms using the command #VBT :

```
AT#VBT=1
OK
```

The call can be transferred (PBX function) by entering the flash dial modifier #VTS=!

```
AT#VTS=!
OK
```

To disable DTMF tone detection, simply issue ATZ at this point or issue the following commands (or use ConfigureAce).

```
At#vls=0
OK
```

```
AT!0048M
0048: 46
```

Enter this command, next line is displayed.

```
0048: 46 46
0049: 8A
OK
```

Type 46 beside the 46 and press the space bar. The next two lines are displayed.

```
AT#cls=8
OK
```

This will disable DTMF tone detection by the modem.

```
ata
VCON
```

```
AT#VLS=7
OK
```

WaveArtist Accelerator Kit User's Guide

At this point, keys pressed on the remote phone keypad will not cause corresponding key numbers to be displayed on the local monitor since you have disabled DTMF tone detection.

9.2.1.3 Using ConfigurAce to Turn Off the Music-on-Hold Filter and Turn-On DTFM Tone Detection

TBD

9.2.2 #VLS=8 - Recording a handset conversation on phone line (Valid after Voice On-line mode)

This command will engage the Caller ID relay to allow recording of conversation when using a handset by routing the signal to the WaveArtist audio codec. To deactivate the Caller ID relay, issue an AT#VLS=0 or AT#VLS=6 to return to phone line or speakerphone mode, respectively.

1. Make sure the **Phone Slider** in the mixer **Record** panel is selected, and the **Phone Slider** in the mixer **Playback** panel is set to MAX volume.
2. Establish a call. Two ways, either local person picks up handset and dials out, or remote person dials in and local person answers by picking up the handset. Both users can hear each other at this point.
3. Hyperterminal is then opened.
4. Issue proper AT commands so that handset conversation recording takes place. The audio chip should record a .WAV file.

```
at&f
```

```
OK
```

```
at#cls=8           Locally we issue these commands, which mutes local handset.
```

```
OK
```

```
ata
```

```
VCON             After VCON , both sides can now hear each other.
```

```
at#vls=8
```

```
OK
```

```
ATL3           After this command, we open Sound Recorder and record the handset conversation. Select mono recording and enable the PHONE LINE slider in the mixer.
```

```
at#vls=9       Issue this command to playback the recorded file. Remote will get muted out, local person can hear the recorded file over his handset when the playback button is pressed.
```

```
VCON
```

One can press the record button, speak into the local handset, then record a new file, then play it back again. This is local handset record and playback (AT#VLS=9).

9.2.3 #VLS=9 - Recording/Playback from HANDSET through the WaveArtist Audio Chip (valid after Voice On-line mode)

This command routes the handset signals to the WaveArtist audio codec to allow recording/playback of audio (e.g., greeting messages) through the local handset. The VCON message means that the modem connects in voice mode through either the line or local handset (Off-Hook or Voice relays). The #VLS=9 is the same as #VLS=1 except the local handset is routed to the WaveArtist audio chip instead of the Datapump. However, like #VLS=8, you could select the output of the Datapump to record by selecting the LINE input under RECORDING CONTROL panel of the MIXER. Please refer to the previous section to learn about how #VLS=9 is implemented.

9.2.4 Switching Between #VLS Settings

Switching between different #VLS settings during Voice On-Line mode (VCON) is permitted as seen above, although only certain conditions may be useful. The #VLS settings are grouped into LOCAL and REMOTE modes. Switching between #VLS settings should be within either LOCAL or REMOTE groups.

LOCAL #VLS settings are defined as the modem being ON-HOOK and isolated from the telco line during VCON mode. The LOCAL settings are #VLS=1, #VLS=2, #VLS=3 and #VLS=9. REMOTE #VLS settings are defined as the modem being OFF-HOOK and connected to the telco line during VCON mode. The REMOTE settings are #VLS=0, #VLS=4, #VLS=5, #VLS=6, #VLS=7, #VLS=8.

9.2.5 Reporting of Local Handset Status

The modem reports the OFF-HOOK to ON-HOOK and ON-HOOK to OFF-HOOK transition of the local handset by the <DLE>h and <DLE>t characters, respectively. The handset status is reported after the issuing of the AT#CLS=8 command and updated whenever transitions of the handset status are detected. This handset status reporting does not depend on the modem being in VCON mode or not. This is useful for auto dialer applications which need to know the handset transitions during and after dialing process.

9.2.6 Notes

1. In speakerphone mode, our modems can't be used to record using any #VLS commands.
2. #VLS=3 and #VRX is for a handset to handset conversation recording while modem records an ADPCM format.
3. Using #VLS=8 a handset to handset conversation is recorded using the audio chip (*.wav) file. You can record in mono mode. Make sure that under the mixer record panel you select the phone slider for recording.
4. When you go into speakerphone mode (AT#cls=8#VRN=0#VLS=6) you can record the conversation by using the Win'95 record application under multimedia and record in STEREO mode. Only stereo will work in this mode. Make sure that under the mixer record panel you select the phone slider for recording.
5. In using the SYNCRO Office version 2.0 to do phone conversation recording with the WaveArtist Combo Card platform: you will need to create under multimedia a setting to record in stereo mode, then use this setting as a default setting for the SYNCRO application. Enter the SYNCRO mailbox by clicking the OPEN button in SYNCRO, click the INCOMING button, select the new setting you have set, then close it. Open the Windows '95 mixer and select PHONE under RECORD panel, close the mixer. Then open SYNCRO , make a call and instead of pressing the CALL RECORD button , press the round circular button underneath the tape, then press record, record the speakerphone conversation, press stop, then save the file as something other than the GREETING1.WAV file. You can play back the recorded speakerphone conversation at a later time.

9.3 OPERATION IN AUDIOSPAN MODE

AudioSpan allows simultaneous voice and data operation using a Rockwell modem connected to a telephone line. Voice and data channels are combined in the analog domain for AudioSpan.

Establishing an AudioSpan connection is analogous to establishing a regular data modem connection. Initiate the call using normal dialing (ATD) and answering (ATA) procedures. The modem can switch from a regular phone conversation into AudioSpan mode and back to phone conversation. A handset, headset, or microphone/speaker can be used for voice communication during AudioSpan mode.

AudioSpan operates in normal (non-error corrected) or error-corrected/compression mode (MNP 5 or V.42 bis depending on the error correction settings of the modems). The DTE rate must be equal to or greater than the anticipated DCE connection speed. In general, DTE speed of 38400 bps or higher should be used.

AudioSpan can be used by running a communication software application or interactive games which support the Rockwell AudioSpan function. Follow the instructions of the respective application package. Alternatively, AudioSpan can be used by manually issuing AT commands to the modem as described in Section 9.2.

9.3.1 Manual Operation Using Terminal Mode

9.3.1.1 Originating an AudioSpan Call

1. Invoke the terminal mode in your communications package. Be sure your DTE speed is at least 38400 kbps and configured for 8 bit data, no parity, 1 stop bit.
2. Enter **AT** command. The modem will respond with **OK**. **Note:** For all AT commands, press the RETURN key after keying the AT command string to invoke the command.
3. Enter **AT&F** to reset the modem configuration to default values. All instructions to the modem are communicated through AT commands. For example, ATD is the AT command for the modem to dial; all AT commands start with the "AT" characters. Refer to the modem Designer's Guide for a list of the AT commands that the Target Board supports.
4. Enter **AT-SMS=2**. The modem will respond with **OK**. This will initialize the modem for AudioSpan mode using the handset as the voice/audio interface. Be sure handset is on the cradle (hung up). If you wish to use to the headset as the voice/audio interface, enter **AT-SMS=2#VLS=5**.
5. To dial, enter **ATDTnnnnnnn** where **nnnnnnn** is the phone number of a remote party. You will hear some high pitched tones, then something that sounds like static after the remote modem picks up your call. If the call progress went smoothly, you will see **CONNECT** on your terminal. You can send data to the remote modem by sending characters via your keyboard.
6. If the modem is configured for AudioSpan handset mode, you can pick up the handset to signal the other party to answer the voice call. Speak into the handset as in an ordinary phone call to communicate to the other party. Hang up the handset when no voice communication is required to increase data throughput. You will hear a periodic beeping tone on the modem speaker if the remote party wishes to signal you to pick up the handset.
7. If the modem is configured for AudioSpan headset mode, you can use the headset to communicate to the remote user.
8. After you have finished your session with the remote modem, you may want to hang up (if the remote modem doesn't hang you up automatically). To hang up, type in three plus signs "+++" in a row (delay less than one second between characters) to get to the AT command mode and you will see "OK". Then enter **ATH** and your modem will terminate the connection.

9.3.1.2 Answering an AudioSpan Call

1. Invoke the terminal mode in your communications package. Be sure your DTE speed is at least 38400 kbps and configured for 8 bit data, no parity, 1 stop bit.
2. Enter **AT** command. The modem will respond with **OK**. **Note:** For all AT commands, press the RETURN key after keying the AT command string to invoke the command.
3. Enter **AT&F** to reset the modem configuration to default values.
4. Enter **AT-SMS=2**. The modem will respond with **OK**. This will initialize the modem for AudioSpan mode using the handset as the voice/audio interface. Be sure handset is on the cradle (hung up). If you wish to use to the headset as the voice/audio interface, enter **AT-SMS=2#VLS=5**.
5. To answer a call in AudioSpan mode upon receipt of a **RING** message, enter **ATA**. The modem will report **CONNECT** to indicate a data connection is established.
6. If the modem is configured for AudioSpan handset mode, you can pick up the handset to ring the other party to answer the voice call. Speak into the handset as in an ordinary phone call to communicate to the other party. Hang up the handset when no voice communication is required to increase data throughput. You will hear a periodic beeping tone on the modem speaker if the remote party wishes to signal you to pick up the handset.
7. If the modem is configured for AudioSpan headset mode, you can use the headset to communicate to the remote user.
8. After you have finished your session with the remote modem, you may want to hang up (if the remote modem doesn't hang you up automatically). To hang up, type in three plus signs "+++" in a row (delay less than one second between characters) to get to the AT command mode and you will see "OK". Then enter **ATH** and your modem will terminate the connection.

9.3.2 Commands Supported by AudioSpan

-SMS = x, y, z, t - Select AudioSpan/DSVD Mode

#VLS = x - Voice Line Select

-SMC = x - Enable/Disable ML144 Data Burst

-SQS = x, y - Select AudioSpan Modulation

9.3.2.1 -SMS = x, y, z, t - Select AudioSpan/DSVD Mode

The x parameter selects Data, AudioSpan, or DSVD mode, or enables automatic mode selection. The y, z, t parameters are optional and are required only if the user wishes to control connection speeds. For example, AT-SMS=2 is sufficient to enable SVD.

x: AudioSpan/DSVD/Data mode select and automatic mode select enable

- 0 = Data mode
- 1 = DSVD mode (A modem not supporting DSVD will respond with ERROR)
- 2 = AudioSpan mode (A modem not supporting AudioSpan will respond with ERROR)
- 3 = Automatic mode select (DSVD/AudioSpan/Data) (Default)

Note: AT-SMS=1 performs the same operation at AT-SSE=1.

y: Minimum data speed (bps) with audio for AudioSpan mode (see y value in following table)

z: Maximum data speed (bps) with audio for AudioSpan mode (see z value in following table)

y or z Value	Modulation Selected (See -SQS Command)		
	V.61	ML144	ML288
4800	S (y and z Default)	S (y Default)	S (y Default)
7200	—	S	S
9600	—	S (z Default)	S
12000	—	—	S
14400	—	—	S (z Default)

S = Supported.
 — = Not supported.

t: Symbol rate (ML288 modulation only)

- 0 = Auto Selection (Default)
- 1 - 6 = Reserved

The symbol rate must be set to 0 for normal operation (default). The other symbol rate selections are for test purposes only.

Notes

AudioSpan audio quality is dependent upon modulation mode, data rate and telephone line quality. Some guidelines are:

1. Higher quality telephone lines provide better audio quality than impaired telephone lines.
2. A lower data speed with audio provides better audio quality than higher data speed with audio. For example, a ML288/9600 connection will be audibly superior to a ML288/14400 connection.
3. For identical data speed with audio using different modulations (e.g., ML144 vs. ML288), the audio quality at ML288 will be superior. For example, a ML288/9600 will be audibly superior to a ML144/9600 connection.

WaveArtist Accelerator Kit User's Guide

Examples

1. AT -SMS=2 selects AudioSpan Mode (the y, z, and t parameters are not required).
2. AT -SMS=2,4800,9600 selects AudioSpan Mode, specifies the minimum data speed with audio of 4800 bps, and specifies the maximum data speed with audio of 9600 bps.

9.3.2.2 #VLS = x - Voice Line Select

- 0 = Telephone handset (Default)
- 5 = Headset
- 6 = Speakerphone

The AT#VLS setting must be issued prior to establishing a DSVD or AudioSpan connection if a voice line other than the default telephone handset is desired.

9.3.2.3 -SQS = x, y - Select AudioSpan Modulation

x: Select modulation mode

- 0 = V.61
- 1 = ML144 (Default for RCV144)
- 2 = ML288 (Default for RCV288)

y: Enable/disable AudioSpan automatic modulation (automode) selection (V.61, ML144, ML288)

0 = Disable AudioSpan automodulation (Host selects AudioSpan modulation specified by the x parameter. If the selected modulation is not supported by the modem, ERROR is reported and the x parameter is not changed. If the remote modem does not support the selected modulation, the modem disconnects.)

1 = Enable AudioSpan automodulation (Default. The modem starts with the AudioSpan modulation specified by the x parameter and falls back from ML288, to ML144, to V.61, or to data mode (e.g., V.34 or V.32 bis) depending on the selected x parameter, the remote modem capability, and line conditions.)

Note: The AT-SQS parameters should remain at default unless a particular modulation is preferred.

Examples

1. AT -SQS=2,1 enables AudioSpan automodulation starting with ML288 modulation.
2. AT -SQS=2,0 disables AudioSpan automodulation and selects ML288 modulation.
3. AT -SQS=1,0 disables AudioSpan automodulation and selects ML144 modulation.

9.3.2.4 -SMC = x - Enable/Disable ML144 Data Burst

- 0 = Disable data burst
- 1 = Enable data burst (Default)

ML144 data burst can be enabled using the -SMC command in ML144 modulation. Data burst will keep the audio channel open only when energy is detected on the handset or headset. When silence is detected in data burst mode, the connected modems will upshift in speed for higher throughput. Disabling data burst mode will keep the audio channel open at all times during the AudioSpan connection.

WaveArtist Accelerator Kit User's Guide

9.3.3 AudioSpan Examples

Example 1: Establish a AudioSpan data connection between two RCV336 modems and use handset as audio interface. Both DTEs are set at 57600 bps:

Originate Modem		Answer Modem		Comments
DTE	DCE	DTE	DCE	
AT&F		AT&F		Reset modems.
	OK		OK	
AT-SMS=2		AT-SMS=2		Enable AudioSpan with default settings.
	OK		OK	
ATDTxxxx				Originate modem dials remote modem.
			RING	
		ATA		Answer DTE responds to RING by answering.
	CONNECT 57600		CONNECT 57600	AudioSpan is established and users can pick up handsets to converse. The connect message represents the DTE speed on each side.
<data>		<data>		Modems exchange data.
				Users hang up handsets to terminate audio link.
+++				Originate modem enters command mode to prepare for disconnect.
	OK			
ATH				
	NO CARRIER		NO CARRIER	Modems disconnect.

WaveArtist Accelerator Kit User's Guide

Example 2: Switch from normal handset conversation to AudioSpan data connection between two RCV336 modems. The originate DTE is set to 57600 bps and the answer DTE is set to 115200 bps:

Originate Modem		Answer Modem		Comments
DTE	DCE	DTE	DCE	
				Users establish handset conversation and both handsets are off-hook.
AT&F		AT&F		Reset modems.
	OK		OK	
AT-SMS=2		AT-SMS=2		Enable AudioSpan with default settings. Modems are aware handsets are already being used due to line current sensing.
	OK		OK	
ATD				Originate modem initiates data negotiation but will not actually dial since the handset is already offhook.
			RING	Answer modem detects negotiation sequence and reports RING message to DTE.
		ATA		DTE responds to RING by answering.
	CONNECT 57600		CONNECT 115200	AudioSpan is established and user's can resume conversation. The connect message represents the DTE speed on each side.
<data>		<data>		Modems exchange data.
		+++		Answer modem enters command mode to prepare for disconnect.
			OK	
		ATH		
	NO CARRIER		NO CARRIER	Modems disconnect in AudioSpan mode but handsets are still offhook and conversation can continue. Conversation is terminated when both handsets are hung up.
<p>Note: The transition from handset conversation to AudioSpan mode can take up to 8 seconds. The handsets will be silenced during the negotiation period.</p>				

WaveArtist Accelerator Kit User's Guide

Example 3: Switch from normal handset conversation to AudioSpan data connection between two RCV336 modems in normal (non-error corrected) mode. Headset operation will be selected on the originate modem and speakerphone operation will be selected on the answer modem as the audio interface during AudioSpan connection. The originate DTE prefers a ML288/14400 connection for good audio quality and does not require high throughput. Both DTEs are set at 57600 bps:

Originate Modem		Answer Modem		Comments
DTE	DCE	DTE	DCE	
				User's establish handset conversation and both handsets are off-hook.
AT&F\N0		AT&F		Reset modems. Normal mode operation is selected by originate DTE.
	OK		OK	
AT#VLS=5		AT#VLS=6		Handset mode selected for originate mode. Speakerphone mode selected for answer modem.
	OK		OK	
AT-SMS= 2, 14400 ,14400		AT-SMS=2		Enable AudioSpan. Originate DTE wishes to force a ML288/14400 with audio connection.
	OK		OK	
ATD				Originate modem initiates data negotiation but will not actually dial since the handset is already offhook.
			RING	Answer modem detects negotiation sequence and reports RING message to DTE.
		ATA		DTE responds to RING by answering.
	CONNECT 57600		CONNECT 57600	AudioSpan is established and user's can resume conversation. The connect message represents the DTE speed on each side.
<data>		<data>		Modems exchange data.
		+++		Answer modem enters command mode to prepare for disconnect.
			OK	
		ATH		
	NO CARRIER		NO CARRIER	Modems disconnect in AudioSpan mode but handsets are still offhook and conversation can continue. Conversation is terminated when both handsets are hung up.
<p>Note: The transition from handset conversation to AudioSpan mode can take up to 8 seconds. The handsets will be silenced during the negotiation period.</p>				

WaveArtist Accelerator Kit User's Guide

Example 4: Establish a ML144/7200 data connection between two RCV336 modems in headset mode, then switch to handset later in the session so conversation can continue after modem call is hung up. This may be typical for configuring an interactive gaming software. Both DTEs are set at 38400 bps:

Originate Modem		Answer Modem		Comments
DTE	DCE	DTE	DCE	
AT&F		AT&F		Reset modems.
	OK		OK	
AT-SQS=1				Select ML144 AudioSpan modulation.
	OK			
AT-SMS=2, 7200,7200		AT-SMS=2, 7200,7200		Enable AudioSpan with both DTEs choosing ML144/7200 with audio as the connection.
	OK		OK	
AT#VLS=5		AT#VLS=5		
	OK		OK	
ATDTxxx				Originate modem dials remote modem.
			RING	
		ATA		DTE responds to RING by answering.
	CONNECT 38400		CONNECT 38400	AudioSpan is established and headsets are used for conversation.
<data>			<data>	Send data between modems.
				Users can pick up handsets to automatically switch to handset modes during AudioSpan. A conversation can continue even if one user picks up the handset. In this example, both users will pick up the handset.
+++				Originate modem enters command mode to prepare for disconnect.
	OK			
ATH				
	NO CARRIER		NO CARRIER	Modems disconnect in AudioSpan mode but handsets are still offhook and conversation can continue. Conversation is terminated when both handsets are hung up.

WaveArtist Accelerator Kit User's Guide

Example 5: Originate modem places speakerphone call to remote handset which is connected to the answer modem. The originate modem switches from speakerphone mode to establish a AudioSpan/Speakerphone data connection between two RCV336 modems. The originate DTE is set to 57600 bps and the answer DTE is set to 115200 bps:

Originate Modem		Answer Modem		Comments
DTE	DCE	DTE	DCE	
AT&F#CLS=8 #VLS=6#VRN=0		AT&F-SMS=2 #VLS=6		Modems are reset. Originate modem is configured for speakerphone call. Answer modem is configured for AudioSpan speakerphone call.
	OK		OK	
ATDT5551212			RING	Answer modem is called but user picks up handset to establish conversation.
	VCON			
AT#CLS=0				Originate modem switches to data mode. Audio on both sides will be muted while the originate modem is in #CLS=0.
	OK			
AT-SMS=2 #VLS=6				Modem is configured for AudioSpan with speakerphone mode selected.
	OK			
ATD				Originate modem initiates data negotiation but will not actually dial since the handset is already offhook.
			RING	Answer modem detects negotiation sequence and reports RING message to DTE.
		ATA		DTE responds to RING by answering.
	CONNECT 57600		CONNECT 115200	AudioSpan is established and users can resume conversation on speakerphone. The connect message represents the DTE speed on each side.
<data>		<data>		Modems exchange data.
		+++		Answer modem enters command mode to prepare for disconnect.
			OK	
ATH				
	NO CARRIER		NO CARRIER	Modems disconnect in AudioSpan mode and speakerphone conversation is terminated.
<p>Note: The transition from handset conversation to AudioSpan mode can take up to 8 seconds. The handsets will be silenced during the negotiation period.</p>				

10. TROUBLESHOOTING

For questions regarding "AT" commands and operation of the WaveArtist modem, refer to the AT Command Reference Manual and the RCV336ACF/SP Data Sheet. For questions or comments regarding the WaveArtist Reference Design, please contact a Rockwell Field Applications Engineer at the local Rockwell sales office near you.

10.1 RESOLVING HARDWARE CONFLICTS

This section describes the possible hardware conflicts between the WaveArtist and other interface cards in your system, and ways of resolving these conflicts.

Hardware conflicts occur when two or more devices use the same I/O address, IRQ, or DMA channel. The default setting of the WaveArtist is as follows:

Audio (Sound Blaster mode)

- DMA = 1
- I/O Address = 220H
- IRQ = 7

Audio (Windows Sound System mode)

- DMA = 7
- I/O Address = 250H
- IRQ = 10

Modem:

- COM3 = I/O Address 3E8H
- IRQ = PnP assigned.

This setting might come into conflict with other devices. For example:

- Scanner
- Printer
- SCSI Hard Disk Drive
- Ethernet LAN card.

To resolve hardware conflicts:

1. Find out the current board setting (DMA channel, IRQ, I/O port address) of the WaveArtist.
2. If you know of any peripheral card in your system that is using the same setting, change the hardware setting on the peripheral card or the WaveArtist.
3. If you are unsure of the settings of the peripheral card, remove all cards except the WaveArtist and other essential cards from your system. Re-initialize the WaveArtist each time you remove an interface card. If your WaveArtist functions properly after removing an interface card from your system, the interface card you just removed was in conflict with your WaveArtist. Find out the DMA channel, Interrupt request line, I/O port address which the interface card is using. Change the settings on your WaveArtist or the interface card so that the two are not using the same values.

10.1.1 Windows 95 Environment

10.1.1.1 Trouble Shooting Installation (Windows 95)

<p>NOTE It is important that you have removed all of the associated files from your PC before installing your new Audio Combo Card. Please follow the uninstall procedure. This will ensure that you start out with a clean Windows 95 environment.</p>

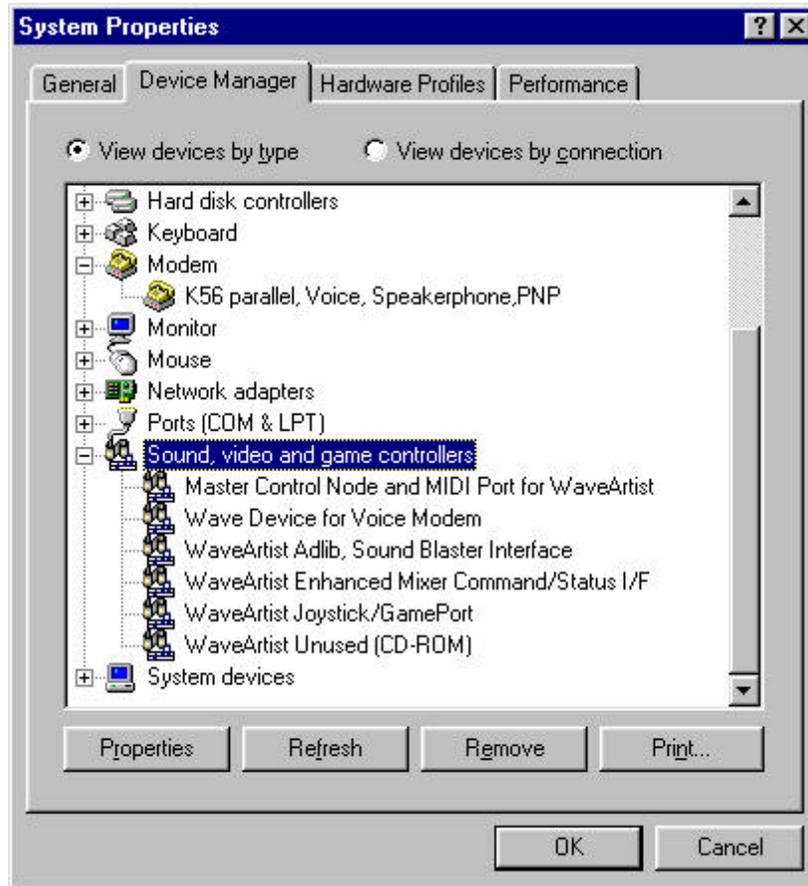
1. After installation, make sure you delete the "FILE TRANSFER" icon that may loaded via the startup taskbar. This will conflict with Hyperterminal, even though it shouldn't. This bug is being worked on at this time. You only need to do this if you have done so already.
2. From the Start button\ Settings\Taskbar\Start Menu Programs\Advanced\Programs\Startup , move FileTransfer icon by dragging it over to the Accessories folder. Do this only if you have not done this already.
3. Look under Control Panel\System\Device Manager and check that there are no conflicts with any of the five WaveArtist components loaded or the modem loaded.
4. If there are conflicts as far as the modem and the COM ports, you should disable the COM ports by taking out the check mark by "Original Configuration (Current)" under the System\Device Manager\Communications Port COM1 properties. You may also have to change the IRQ setting of the WaveArtist modem if the interrupts are not set correctly automatically. That is, you may have to select one of the many different configurations available and you may have to choose the IRQ or address that you prefer to use when running a DOS game.
5. On some PC's, we have found that the CD-ROM drive is no longer accessible and yet Windows 95 does not detect this problem or show any conflicts. When trying to read a CD in the drive, Windows 95 will simply state "Drive is inaccessible". This problem is a BIOS related problem and you will need to upgrade your BIOS. Please refer to the internet in order to download the latest BIOS for your PC. Award BIOS is especially problematic.

10.1.1.2 Trouble Shooting Uninstall (Windows 95)

The following procedure uninstalls the WaveArtist installation files from your PC, using some of the Windows '95 support options.

1. Choose **Start\Settings\Control Panel\System\Device Manager**. The **System Properties** box is displayed.

WaveArtist Accelerator Kit User's Guide



1. In **Device Manager** box, remove any modem and sound device drivers that have previously been installed.

Example 1: Click the plus sign next to the **Modem** icon. Select the following modem driver and Click **Remove**. When prompted by the **Confirm Device Removal** box, click **OK**.

V.34 parallel, VoiceView, Speakerphone...

Example 2: Click the plus sign next to the **Sound, video and games controllers** icon. Select the following drivers, one at a time, and Click **Remove**. When prompted by the **Confirm Device Removal** box, click **OK**.

Rockwell Voice Modem Serial Wave Device

Wave Device for Voice Modem

WaveArtist Adlib, Sound Blaster, and Master Control I/F

WaveArtist Enhanced Command/Status and Mixer I/F

WaveArtist Game/Joystick Port

WaveArtist MIDI Port [MPU-401]

WaveArtist Unused [CD-ROM]

NOTE Additional devices that might be found depending on what devices are configured initially, which will have to be removed as well are, "WaveArtist IDE Controller" in the **Hard Disk Controllers** section, and "WaveArtist Hardware Analog Spatializer" in the **Sound, video and games controllers** section of the device manager.

2. In Windows Explorer, choose **My Computer\C: drive\Windows\Inf**, In the **Inf** folder, delete all OEMx.inf files that are associated with a modem or WaveArtist. Normally these files are Oem0.inf, Oem1.inf, Oem2.inf, etc. Additional .inf

WaveArtist Accelerator Kit User's Guide

files include the WaveArtist IDE .inf file (WAIDE.inf) and the WaveArtist Hardware Analog Spatializer .inf file, depending on if these devices were configured initially.

NOTE There may be other files with similar names but they will be associated with other card that have been installed, such as a Video card. Do not delete such files, therefore, open the file and look at it before deleting it. The modem file for the WaveArtist will have Rock_15x_.inf mentioned near the top of the file.

3. In Windows Explorer, choose **My Computer\C: Drive\Windows\System**, In the **System** folder, delete the following files:

NOTE You may have a different directory path for these files, but you should be able to find these under \Windows\System folders. These files are not automatically removed by Windows '95 when you remove your audio combo card from your PC. You may have to enter DOS mode in order to delete some of these files if Windows '95 does deny you the right to delete these files.

Brooktree WaveStream files exist even if WaveStream was NOT installed. In this case the listed files below are shell files copied from the WaveArtist installation floppy. If WaveStream is installed, some of them are overwritten by the real WaveStream drivers. For a complete uninstall, the below listed WaveStream files should be deleted regardless of being a "shell" or a "real" file.

To Update WaveArtist Drivers, if WaveStream is already installed, do not delete the WaveStream files listed below. If the user is prompted by Windows '95 during installation, he should say "Don't Overwrite" for the below listed WaveStream files when prompted about the dates being newer than the ones on the new WaveArtist driver floppy. If this is not done, one will wipe out the WaveStream files with a set of "Shell" files from the new WaveArtist driver floppy. The end result will be that WaveStream will not work and you will have to re-install WaveStream again.

Rwa95drv.vxd

Rwa95vxd.vxd

Rwados95.exe

Rwautoex.exe

Setwapnp.exe

Rwa95dos.ini

Rwawsdrv.drv (Associated with the Brooktree WaveStream software)

Msgloop.exe (Associated with the Brooktree WaveStream software)

Wlstream.dll (Associated with the Brooktree WaveStream software)

Vwstream.vxd (Associated with the Brooktree WaveStream software)

4. Remove the Rwa.drv section from the System.ini file.
5. Remove the following lines from the Autoexec.bat file:
 - c:\Win95\System\Rwados95
 - c:\Win95\System\Setwapnp /clr
6. Remove the following lines from the c:\Win95\dosstart.bat file:
 - c:\Win95\System\setwapn
 - c:\Win95\System\rwautoex

WaveArtist Accelerator Kit User's Guide

7. Return to the calling procedure or turn off the PC and remove the WaveArtist card.

The following procedure uninstalls the WaveArtist installation files from your PC, manually. Follow this procedure

1. It would help greatly if you disable any of your serial ports via your BIOS, if you are not using them. However, Windows 95 may go back and re-install the drivers for the ports. However, you will be able to permanently disable the ports in Windows 95 by following the previous sections.
2. Choose **Start\RUN**. In the **RUN** dialog box, enter **Regedit\HKEY_Local_machine\ENUM\SAPNP** and click **OK**. Delete everything and all folders except the folder named "READDATAPORT".
3. Choose **Start\RUN**. In the **RUN** dialog box, enter **Regedit\HKEY_Local_machine\ENUM\MODEMWAVE** and click **OK**. In the **MODEMWAVE** folder, delete any folders labeled with an associated modem such as "V.34_Parallel_Voice_View_Speakerphone_MediaLink_Plug&Play".
4. Choose **Start\RUN**. In the **RUN** dialog box, enter **Regedit\HKEY_Local_machine\SYSTEM\Current Control Set\Services\Class\Media**. In the **Media** folder, delete all folders labeled 0000, 0001, 0002, 0003, 0004, etc., or any other folder. Check that each folder mentions "WaveArtist" before deleting it. These folders contain your links to the audio.inf files. Delete only folders, i.e., do not delete any separate files.
5. Choose **Start\RUN**. In the **RUN** dialog box, enter **Regedit\HKEY_Local_machine\SYSTEM\Current Control Set\Services\Class\Modems**. In the **Modems** folder, delete all folders labeled 0000, 0001, 0002, 0003, 0004, etc. or any other folder. Check that each folder mentions "WaveArtist" before deleting it. These folders contain your links to the modem.inf files. Delete only folders, i.e., do not delete any separate files..
6. Choose **Start\Settings\Taskbar\Start Menu Programs\Advanced\Programs\Startup**. Move the **FileTransfer** icon to the **Accessories** folder.
7. Remove VoiceView Auto Detect so that the icon does not come up each time you power on your PC: Choose **Start \Settings\Taskbar\Start Menu Programs\Advanced**. In the **Programs\ StartUp\VoiceView Auto Detect**, move this icon to the PROGRAMS directory. If you ever want to invoke the File Transfer program, you would click on it from the PROGRAMS directory.

10.1.2 Windows 3.1 Trouble Shooting

1. In windows, under control panel \ Drivers , if you have the ROLAND.LAPC1 driver, please remove it.
2. If you do not already have the MIDI Mapper installed, please use the control panel\drivers applet to add the MIDI Mapper. Use the MIDI mapper to select MIDI or FM synthesis to play MIDI files. If you select MIDI, you must use the ROLAND MPU-401 driver. If you select WaveArtist, you are selecting the WaveArtist FM synthesis feature.
3. Make sure that the address and IRQ selected for MPU-401 are the same when in Control Panel \ Drivers , when clicking on SETUP for ROLAND MPU-401 and ROCKWELL WaveArtist. You will need to know what interrupts and addresses are used by the rest of your system if you run into any conflicts.
4. You may find that after rebooting Windows 3.1, your mouse is frozen, or an MPU-401 error applet may show up. This means that there is a conflict. You will have to use your Windows expertise to get the card working. You can go into Main\Control Panel \ Drivers\Rockwell WaveArtist \Settings and change the MPU-401 I/O and IRQ settings. These should match the Roland MPU-401 I/O and IRQ settings. The Roland settings are found next to the Rockwell WaveArtist name under the Drivers icon.
5. Under Rockwell WaveArtist drivers, you may have to change the SB I/O address and SB IRQ settings as well if there are conflicts with other cards in your PC. You will have to try it and test and try again until you have gotten rid of the conflicts.

10.1.3 EEPROM Programming Troubleshooting

1. During the verification process, the same number of bytes programmed will be verified. If the programmed numbers do not match those programmed, this will indicate that an error has occurred while programming the EEPROM. There

WaveArtist Accelerator Kit User's Guide

should be no more than 256 bytes that are programmed depending on the version you are using. If the programming does not finish, try again.

10.2 LAYOUT GUIDELINES

It is recommended that the Layout Guidelines outlined in the various documents mentioned in the Applicable Documents section above, be adhered to in order for high quality boards to be produced. Below are more rules that will make a difference in a low noise/high quality board versus a noisy board.

1. The placement of the components can not be spread out on the board. Moving the components closer not only saves board space and cost, but it will also keep analog traces and critical digital traces short. Thus, this will reduce any noise coupling effects.
2. As above, capacitors for Vref and Vc signals and bypass capacitors for the audio device need to be placed closed to the audio device. Vref and Vc are used for DC bias of the codec inside the WaveArtist devices (RWA010, RWA300, etc.). It is very important to keep the capacitors close to the signal pins.
3. To get good Signal to Noise ratios above 80dB, provide a voltage regulator for the audio device codec as done in our reference designs.
4. Analog and digital signals MUST be isolated. Do not have digital signals crossing over an analog area.
5. Keep all analog traces short and away from digital signals.
6. Keep all analog traces 12 to 15 mils in thickness.
7. Provide proper bypass capacitors close to audio/modem power pins (Vc, Vref, etc.).
8. Analog power pins must be kept clean and free of coupling of noise.
9. Fill in the blank areas underneath the audio/modem devices with ground planes and thicken ground traces for good ground return.
10. The BGA and QFP devices contain an analog codec at the upper right corner. When filling underneath the devices, have a digital and an analog ground plane, isolating the areas of the devices separately.
11. Provide thick traces for all power and ground pins on the audio device.
12. Follow our reference design as far as high frequency noise filtering at the output of the audio device.
13. Try to keep the microphone signal isolated. This signal is very sensitive to noise.

10.3 FREQUENTLY ASKED QUESTIONS (FAQs)

Q- Where may a customer purchase the Rockwell part 5444R04-001 for the European WaveArtist boards (eg. AK28-D180) ?

A- Roederstein Electronics Inc., 2100 West Front Street, Statesville, NC 28677. (704)872-8101.

Q- What BIOS version should I use for a Dell Dimension XPS PxxxS ?

A- You should always use the latest on the Dell Web page: <http://www.dell.com/prodinfo/desktops/dim/xps/>

B- At this time 12/1/1996, the latest BIOS version that Dell is offering is : AMI A04 Bios.

Q- What BIOS version should I use for a Dell Dimension XPS PxxxC ?

A- At this time 12/1/1996, the latest BIOS version that Dell is offering is : AMI A06 Bios.

B- It was found that AMI A04 Bios was problematic on this platform. The CD-ROM drive disappeared when a combo card was installed into the system. Therefore, Dell decided to upgrade the AMI Bios for this platform.

Q - In Windows 95, what are the problems seen with installation and how do I install the WaveArtist card on the IBM Thinkpad model 750Ce ?

A - Use the following procedure to help you understand more about installation:

1. You will need to set the 8 bit DMA channel for playback on the Thinkpad 750Ce and you will need to disable the onboard sound on the Thinkpad 750Ce and 755CD models for proper WaveArtist functionality.
2. To set the 8 bit DMA channel for playback, follow the below procedure:
3. Before installing the WaveArtist card into your Thinkpad model 750Ce, Choose **My Computer\Control Panel\System Icon\Device Manager\Sound, Video and Game Controllers icon**.
4. Choose WaveArtist Adlib, Soundblaster and Master Control I/F.
5. Click on the **Properties** button and select **Settings\Preferred Assignments for this Channel\Play button for 8 bit DMA Channel**.
6. Selecting 8 bit DMA channel for Playback will force the 16 bit DMA channel to record.
7. Do not install the WaveArtist card into the Thinkpad until you have disabled the onboard sound on the Thinkpad. Follow the below procedure:
8. Choose **Start button\Programs\Windows Explorer\Thinkpad** and look for a PC icon labeled "**Ps2win**".
9. Click on this icon and open the **System Info** icon within.
10. Choose **More\Advance\Disable** button to disable the onboard sound.
11. Do not install the WaveArtist card into the Thinkpad until you have done three more things that apply to both the Windows'95 and Windows 3.x operating systems. Follow the below procedures:
12. You will need to comment out the VXD file named **TPAUD.vxd** by putting a semi-colon in front of this file in the **System.ini** file of your PC. If you do not know how to access the System.ini file in your PC, please contact the WaveArtist PAE's.
13. You will need to do a search on your PC for any files with names like **"*VTP*.*/S "**. Use this search parameter and if any files are found, make sure they are commented out wherever they exist in your PC.
14. You will need to do a search on your PC for any files with names pertaining to other sound cards. Use **Opti*.*, *930*.*, SNDINIT.***, etc etc. delete these files from your Thinkpad since these belong to 1995 combo designs using the Opti audio devices.
15. Please note, for steps 2 through 6, shown above, you will need to use the path: **Control Panel\Drivers\Rockwell WaveArtist\Setup\Advanced Settings** for the Windows 3.x operating system.

WaveArtist Accelerator Kit User's Guide

16. Please note, for step 8, shown above, use the Windows 3.x file manager to locate the “**Ps2win**” file, when using the Windows 3.x operating system.
17. After all of the above is completed, you are ready to install the WaveArtist cards into your IBM Thinkpads. Some of the type of problems you will run into for not following the above steps are crashes, frozen system, and Memory Parity errors. These errors occur when using the Soundblaster 16 card on the Thinkpad 750Ce models, as well.

Q- In using 16 bit Orcad for DOS, why are the schematics partially displayed?

A- Use Width=14.800 and Height=11.500, select Printer driver = HP LaserJet-II 150x150 (Letter Paper) if you have such a printer.

Q- How do I print out a Postscript Print file generated by Orcad?

A- At the A: DOS prompt, enter the command: COPY filename.PRN PRN /B

Q- Is there a need for external 10K ohm pull-up resistors on each of the four button inputs of the Joystick port?

A- On the first generation (10 bit) R7127 devices, external pull-ups were necessary, but the 16 bit parts eliminated the need for the pull-ups since pull-ups were designed internally to the devices. This will help eliminate 4 resistors on JA1, JA2, JB1, JB2 signals.

Q - In Windows 95, what IRQ, DMA, I/O and memory is being used by my PC and installed peripheral cards?

A - Use the following procedure to display information that will help you understand more about resource assignments:

1. Choose **Settings\Control Panel\System\Device Manager**.
2. Double-click **Computer**.
3. In the **Computer Properties** box, select **Interrupt request (IRQ)** to view all IRQs used by everything in your PC.
4. In the **Computer Properties** box, select **Input/Output (I/O)** to view the I/O address ranges used by installed devices.
5. In the **Computer Properties** box, select **Direct memory access (DMA)** to view the DMA channels used by installed devices.
6. In the **Computer Properties** box, select **Memory** to view the memory ranges used by installed devices.

Q - In Windows 95, what COM port is my modem assigned to?

A - See the following procedure:

1. Choose **Settings\Control Panel\Modems**.
2. In the **Modem properties** box, click on the **Diagnostics** tab.
3. Select the modem for the WaveArtist card: V.34 parallel, Voice View, Voice, Speakerphone, by selecting the COM icon.
4. Then select the “MORE INFO” button which will send AT commands to the modem and give you a result.

Q - In Windows 95, how do I change the COM port that my Modem is using?

A - See the following procedure:

1. Choose **Settings\Control Panel\Modems**.
2. In the **Modem properties** box, click on the **Diagnostics** tab.
3. View the COM name at the left of the applet which is associated with the V.34 parallel, VoiceView, Voice, Speakerphone,... modem. You can run diagnostics on your modem by clicking on the MORE INFO button, to see if your modem is operational.

WaveArtist Accelerator Kit User's Guide

4. Now, you know what COM port your modem is using after installing the WaveArtist card. (e.g., COM3).
5. Using the information above, click on Start\ RUN , type in REGEDIT and click OK.
6. At the open applet labeled, Registry Editor, open EDIT \ FIND and type in COM3.
7. When you see on the right side of an applet, an icon labeled PORTNAME "COM3", you can double click "PORTNAME".
8. Then you can retype "COM3" into any COM port you feel is open and usable.
9. You can close all of the applets and run diagnostics on this COM port by following the above instructions from 1. to 3.

Q - In Windows 95, how do I enable the Volume Control for the WaveArtist?

A - See the following procedure:

1. Choose **Settings\Programs\Accessories\Multimedia\Volume Control** or double-click on the **Speaker icon in the lower right hand corner of the display screen**.
2. Tick mark the button labeled "Show volume control on the taskbar".
3. Now close the applet.

Q - How do I install the WaveArtist board on a COMPAQ Deskpro 575 XL computer?

A - See the following procedure:

1. On this PC, before installing our WaveArtist card, go to BIOS.
2. Disable the internal built-in audio capabilities.
3. Turn off the PC.
4. Plug in the WaveArtist card and turn on the PC.
5. Go to BIOS and Disable ALL of the "ISA Plug and Play Function x " listed under the "Slot x - Rockwell WaveArtist" that is found by BIOS.
6. Go into Windows 95 and install the card. This is assuming that you have followed the upgrade recommendation specified next.

Q - How do I Upgrade from Windows 3.1 to Windows 95?

A - See the following procedure:

1. If you have sounds cards previously installed or if you have Windows Sound System installed, it is advisable to either delete these out of your SYSTEM.ini , autoexec.bat and config.sys files, or to load a clean Win'3.1 and then upgrade it to Windows 95.
2. Drivers from previously installed sound cards in the Windows 3.1 environment will conflict with the WaveArtist card, after the upgrade to the Windows 95 environment.

Q - How do I convert ORCAD from DOS to Windows?

A1 - When translating from DOS versions of OrCAD:

1. Always have your std.cfg file in your subdirectory. It tells the translator where the libraries are to translate. It also tell what properties such as PIC SPEC to translate.

A2 - When translating from capture from windows to OrCAD for DOS:

1. Capture will let you use parts with the same name from different libraries. DOS versions won't. They will pick the first part they come across in your library order. -- Don't have different parts with the same name if you want to translate to DOS versions.

WaveArtist Accelerator Kit User's Guide

2. Power and ground parts with power pins on them don't translate. Use only power symbols. Most of our DOS schematics have ground parts and not power symbols with the net name assigned. These DOS schematics will translate to windows but won't translate back.
3. Always set up the SDT Compatibility. (Options -- Design Properties -- SDT Compatibility). Pic Specs and other attributes won't translate if you don't.
4. No connects don't always translate to the correct spot on the schematic sheet.
5. Unnamed nets are assigned a nodename in Capture and a node in OrCAD 32 bit. It is always a good idea to assign a name to each net. This will help determine if the translations occurred correctly since a net will not obtain the same name in both cases.

Q - When installing in the Windows 3.1 environment, how can I access the modem in Windows using Terminal or possibly other applications?

A - See the following procedure:

1. Make sure that the port configuration in Windows is not set to Default.
2. If the port config is set to the exact IRQ and address as the WaveArtist setup applet, then the modem will be accessible.

Q - What do I do if I have a WaveArtist board with R6711-11, R6711-11P, R7127-01P, R7127-11P, or R7127-11P2 devices installed?

A - Exchange the boards for updated boards from your local Rockwell RSS sales office.

NOTES

INSIDE BACK COVER NOTES

Headquarters
Rockwell Semiconductor Systems
4311 Jamboree Road,
P.O. Box C
Newport Beach, CA 92658-8902
Phone: (714) 221-4600
Fax: (714) 221-6375

European Headquarters
Rockwell Semiconductor Systems
S.A.R.L.
Les Taissounieres B1
Route des Dolines
Sophia Antipolis Cedex
06905 Valbonne
France
Phone: (33) 93 00 33 35
Fax: (33) 93 00 33 03

For more information:
Call 1-800-854-8099
International information:
Call 1-714-833-6996

URL Address:
<http://www.nb.rockwell.com>
E-Mail Address:
literature@nb.rockwell.com

REGIONAL SALES OFFICES

US Southwest Office
Rockwell Semiconductor Systems
5000 Birch Street
Suite 400
Newport Beach, CA 92660
Phone: (714) 222-9119
Fax: (714) 222-0620

US Southwest Satellite Office
Rockwell Semiconductor Systems
1000 Business Center Circle
Suite 215
Thousand Oaks, CA 91320
Phone: (805) 376-0559
Fax: (805) 376-8180

US South Central Office
Rockwell Semiconductor Systems
2001 North Collins Blvd
Suite 103
Richardson, TX 75080
Phone: (214) 379-9310
Fax: (214) 479-9317

US Southeast Office
Rockwell Semiconductor Systems
900 Ashwood Parkway
Suite 400
Atlanta, GA 30338
Phone: (770) 393-1830
Fax: (770) 395-1419

US Southeast Satellite Office
Rockwell Semiconductor Systems
Arbor Shoreline Office Park
19345 US 19 N.
Suite 108
Clearwater, FL 34624-3156
Phone: (813) 538-8837
Fax: (813) 531-3031

US Northwest Office
Rockwell Semiconductor Systems
US Northwest Office
3600 Pruneridge Avenue
Suite 100
Santa Clara, CA 95051
Phone: (408) 249-9696
Fax: (408) 249-7113

US North Central Office
Rockwell Semiconductor Systems
Two Pierce Place
Chancellory Park
Suite 810
Itasca, IL 60143
Phone: (708) 773-3454
Fax: (708) 773-3907

US Northeast Office
Rockwell Semiconductor Systems
239 Littleton Road
Suite 4A
Westford, MA 01886
Phone: (508) 692-7660
Fax: (508) 692-8185

Australia
Rockwell Semiconductor Systems
Rockwell Australia Limited
3 Thomas Holt Drive
P.O. Box 165
North Ryde, NSW 2113
Australia
Phone: (61-2) 805 5555
Fax: (61-2) 805 5599

Europe Mediterranean
Rockwell Semiconductor Systems
c/o Rockwell Automation S.r.l.
Via Di Vittorio, 1
20017 Mazzo Di Rho (MI)
Italy
Phone: (39 2) 93179911
Fax: (39 2) 93179913

Europe North
Rockwell Semiconductor Systems,
Ltd.
Berkshire Court
Western Road
Bracknell
Berkshire RG12 1RE
England
Phone: +44 1344 486 444
Fax: +44 1344 486 555

Europe South
Rockwell Semiconductor Systems
S.A.R.L.
Tour GAN
Cedex 13
92082 Paris La Defense 2
France
Phone: (33-1) 49-06-3980
Fax: (33-1) 49-06-3990

Germany
Rockwell Semiconductor Systems
Rockwell Int'l GmbH Germany
Paul-Gerhardt-Allee 50 a
81245 Munchen
Germany
Phone: (49-89) 829-1320
Fax: (49-89) 834-2734

Hong Kong
Rockwell Int'l (Asia Pacific) Ltd.
13th Floor, Suites 8-10,
Harbour Centre
25 Harbour Road
Wanchai,
Hong Kong
Phone: (852) 2 827-0181
Fax: (852) 2 827-6488

Japan
Rockwell Int'l Japan Co., Ltd.
Shimomoto Bldg
1-46-3 Hatsudai, Shibuya-ku
Tokyo, 151
Japan
Phone: (81-3) 5371 1520
Fax: (81-3) 5371 1501

Korea
Rockwell-Collins Int'l, Inc.
Room No. 1508
Korea Textile Centre Building
944-31, Daechi-3dong
Kangnam P.O. Box 2037
Kangnam-ku
Seoul
Korea
Phone: (82-2) 565-2880
Fax: (82-2) 565-1440

Singapore
Rockwell-Collins Int'l, Inc.
230 Orchard Road #10-230/232
Faber House
Singapore 0923
Phone: (65) 732-2292
Fax: (65) 733-0835

Taiwan
Rockwell Int'l Taiwan Company, Ltd.
Room 2808 International Trade Bldg.
333, Keelung Road, Section I
Taipei,
Taiwan
10548 ROC
Phone: (886-2) 720-0282
Fax: (886-2) 757-6760