
WaveCenter/PCI

User's Guide

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≡ Introduction ≡

WaveCenter/PCI™ is a PCI soundcard that integrates these digital audio and MIDI features:

- One optical input and one optical output for digital audio (either 8-channel ADAT optical audio, or 2-channel SPDIF optical audio)
- One RCA (coax) input and one RCA (coax) output for 2-channel SPDIF audio
- One 8-pin port with a breakout cable for 2 MIDI inputs and 2 MIDI outputs

Either optical port can be switched from multichannel ADAT optical format to stereo SPDIF format for connectivity with CD players, DAT machines, MiniDisc recorders, or any other TOSLINK-compatible equipment.

WaveCenter/PCI includes a cable that lets you transfer digital audio directly from a CD-ROM or DVD drive, provided that the drive has a compatible 2-pin digital audio output.

WaveCenter/PCI supports 44.1 and 48 kHz sample rates, and dynamically resamples 8, 11.025, 16, 22.05 and 32 kHz digital audio output for playback through high-quality external converters. WaveCenter/PCI can also lock to digital audio inputs from 39–51 kHz.

WaveCenter/PCI provides software controls for digital audio input status, source and destination formats, and sample rate. It is also bundled with Cool Edit Pro SE, a multichannel recording and editing application from Syntrillium Software.



WaveCenter/PCI's ASIO driver provides low-latency performance when adjusting parameters and monitoring inputs with applications such as Cubase VST. WaveCenter/PCI also has a direct GigaSampler Interface driver.

The ADAT optical ports on WaveCenter/PCI can be connected to any device that also has ADAT optical ports, including digital mixers, ADAT-compatible tape machines, digital format translators (such as the Apogee FC-8 for TDIF/ADAT translations), and external A/D & D/A converters such as Frontier Design Group's Tango24™ and Zulu™.

In addition to this User's Guide, your WaveCenter/PCI package should contain:

- WaveCenter/ PCI circuit board
- Breakout cable for 2 MIDI inputs and 2 MIDI outputs (4 standard 5-pin MIDI jacks); connects to WaveCenter/PCI's 8-pin circular connector
- Internal cable for CD-ROM or DVD digital audio
- Envelope containing WaveCenter/PCI software on a 3.5" floppy disk (please read the envelope before opening it)
- CD-ROM with Cool Edit Pro SE recording/editing software and demo versions of industry-leading audio production software

About the Company

Frontier Design Group develops, manufactures and sells digital audio hardware and software. Our goal is to provide high-quality, high-value tools to help our customers be more creative and productive.

We're always interested in receiving your feedback on our products, as well as your suggestions for improvements and new products. You can send email to feedback@frontierdesign.com or send a fax to 603-448-6398.

Technical Support

If you have any problems or questions that aren't addressed in the Troubleshooting chapter or elsewhere in this Guide, there are three ways to get more help:

- Refer to our web site (<http://www.frontierdesign.com>) for information on current revisions, answers to frequently asked questions, troubleshooting procedures, and additional documentation. The web site is available every day, 24 hours a day.
- Send specific questions via email to support@frontierdesign.com. We do our best to respond promptly (usually within one business day).
- For time-critical questions, you can call Frontier Design Group at 1-800-928-3236 (outside the USA, call 603-448-6283). Phone support is normally provided weekdays from 9:30 am to 5:30 pm EST.

≡ Installation ≡

WARNING! The components in your computer and on the WaveCenter/PCI board are sensitive to electrostatic discharge. Follow these precautions to avoid damage caused by static electricity —

- Leave the WaveCenter/PCI board in its anti-static wrapping until you're properly grounded.
- To become grounded, make sure the computer is off but leave its power cord plugged in. Remove the cover, and touch the computer's metal chassis.
- Only handle the WaveCenter/PCI board by its edges and metal bracket.

Installing WaveCenter/PCI

WaveCenter/PCI requires one PCI slot in your computer.

1. Remove the protective plugs from WaveCenter/PCI's two optical ports.
2. Make sure the computer is off (but leave its power cord plugged in), and then remove its cover.
3. Using a screwdriver, remove the blank metal bracket from an empty PCI slot in the computer, and verify that the motherboard has no protruding components that would obstruct the WaveCenter/PCI connectors.
4. Insert the WaveCenter/PCI board into the empty PCI slot, and secure the WaveCenter/PCI bracket with a mounting screw.
5. If your computer has a CD-ROM or DVD drive with a 2-pin digital audio output, you can connect it internally to the WaveCenter/PCI board using the CD-ROM cable included with WaveCenter/PCI. Push one end of the cable into the drive's output connector until it clicks into place.

6. Route the CD-ROM cable inside the computer to WaveCenter/PCI, and push the other end of the cable into WaveCenter/PCI's internal CD-ROM connector (labelled CD-ROM) until it clicks into place.

Note: Not all CD-ROM and DVD drives have a 2-pin digital audio output, and some have the connector but it isn't active (such as many Memorex drives).

For a list of compatible drives, you can refer to the Frequently-Asked-Questions (FAQ) page on our web site (<http://www.frontierdesign.com>).

7. Replace the cover, and restart your computer. As it starts up, Windows detects the presence of the new hardware, and automatically opens an installation wizard. In Windows 95, it's the "Update Device Driver" wizard. In Windows 98, it's the "Add New Hardware" wizard.
8. Follow the instructions in the wizard, letting Windows search for the best driver for your device. You'll need to insert the WaveCenter/PCI Software disk into the floppy drive and click the "Next" button as the wizard leads you through the driver installation process.
9. When the wizard indicates that the WaveCenter/PCI Audio Device is installed, click the "Finish" button.
10. After the installation is finished, remove the floppy disk and keep it in a safe place in case you ever need to re-install WaveCenter/PCI.

Note: WaveCenter/PCI ships with its MIDI ports disabled (to avoid a Windows 95 bug that crashes the system if more than 11 MIDI ports are active).

For details on enabling WaveCenter/PCI's MIDI ports, please refer to the 'System Tab' section of the Software Reference chapter later in this Guide.

When WaveCenter/PCI is installed, its icon appears in the Windows Taskbar (usually near the bottom right of your screen). Double-clicking the icon opens the WaveCenter/PCI control panel.



Your WaveCenter/PCI shipped with the most recent software available at the time. The version number appears below the Frontier Design Group logo on the System tab of the WaveCenter/PCI control panel. See “Software Reference” later in this Guide for more details.

Updating WaveCenter/PCI Software

The latest version of WaveCenter/PCI software is always available on our web site, and you can download it from there for free. You can also register on the web site to automatically receive email whenever the WaveCenter/PCI drivers are updated.

To install the latest version of WaveCenter/PCI software:

1. Go to our web site (<http://www.frontierdesign.com>) and download the latest software, which is contained in a compressed (zip) file. If necessary, you can also download a copy of WinZip.
2. Insert a blank, formatted floppy disk into your computer’s floppy drive.
3. Open the zip file, and extract the enclosed WaveCenter/PCI files onto a floppy disk (and then leave the disk in the floppy drive).
4. Open the Windows Control Panel (Start→Settings→Control Panel), and double-click the System icon.
5. When the System window appears, select the “Device Manager” tab.
6. Click the ‘+’ next to “Sound, video, and game controllers” to open that part of the device tree.
7. Select “WaveCenter/PCI Wave and MIDI Driver,” and click ‘Properties.’
8. When the WaveCenter/PCI Properties window appears, select the “Driver” tab.
9. Click the ‘Update Driver...’ button, and follow the wizard’s instructions, letting Windows search for the best driver for your device.

Installing Cool Edit Pro SE

WaveCenter/PCI comes with a copy of Cool Edit Pro SE, a multichannel recording and editing application created by Syntrillium Software. Cool Edit Pro SE is easy to learn and fun to use.

To install Cool Edit Pro SE:

1. Insert WaveCenter/PCI's CD-ROM into your computer's CD-ROM drive. Your browser will automatically open the WaveCenter/PCI Software Sampler home page from the CD-ROM.

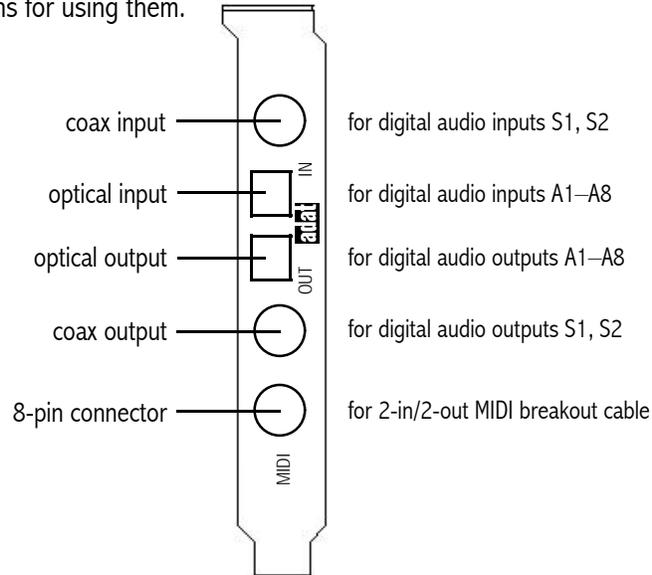
(If your browser doesn't automatically open the CD-ROM, you can open it manually by navigating to the "\Frontier\Default.htm" file on the CD-ROM and double-clicking on it.)

2. When the home page appears, follow its instructions to install Cool Edit Pro SE and the demo versions of other software.
3. After the installation is finished, remove the CD-ROM and keep it in a safe place in case you ever need to re-install Cool Edit Pro SE.

This application is a limited version of Cool Edit Pro. The SE version supports only 10 (mono or stereo) tracks of audio and has no DSP effects. The CD-ROM includes details about how to upgrade your SE version to Cool Edit Pro, complete with 64 audio tracks and more than 30 high-quality DSP effects.

Connecting to Other Devices

WaveCenter/PCI has several types of connectors on it. Here are some suggestions for using them.



— Optical ports and cables —

WaveCenter/PCI ships with plastic plugs covering its optical input and output connectors. Before installing WaveCenter/PCI in your computer, you can remove the plugs by pulling them out of the connectors.

The optical ports accept standard TOSLINK™ optical cables. You can purchase optical cables in lengths up to 10 meters (33 feet) from Frontier Design Group. Many optical cables have small flexible plastic covers on their tips to prevent scratches. Make sure you remove the plastic covers before connecting the cable to an optical port.

The optical connectors are flat on one edge and rounded on the other, so if the cable doesn't easily snap into the port, rotate the end of the cable 180° and try again.

You can connect either end of an optical cable to any optical port, as long as you're connecting an output to an input. The direction of an optical signal is easy to verify because optical outputs emit red light.

The light itself is not dangerous, since TOSLINK and ADAT optical ports use light-emitting diodes (LEDs) rather than laser light.

WaveCenter/PCI's optical ports can be used in either 8-channel or 2-channel mode.

- The 8-channel ADAT mode lets you connect WaveCenter/PCI to digital mixers, multitrack tape machines, multichannel external A/D and D/A converter boxes such as Tango24 and Zulu (also from Frontier Design Group), and other devices that use 8-channel ADAT optical I/O.
- The 2-channel SPDIF mode lets you connect WaveCenter/PCI to DAT machines, CD players, MiniDisc recorders and other devices that use 2-channel SPDIF optical I/O. See the "Software Reference" chapter later in this Guide for more details.

— SPDIF cables —

Standard audio cables have twisted-pair wire rather than coaxial cable, and are not recommended for use with SPDIF (Sony/Philips Digital Interface Format) signals. Although they have the correct connector on each end, and may work over short distances, they are not reliable for SPDIF data streams. The reason is related to the differences between audio and SPDIF signals — audio signals contain frequencies in the tens of kiloHertz, but SPDIF signals contain frequencies in the tens of megaHertz, much like a video signal.

For reliable SPDIF connections, especially over distances longer than a meter, you should use 75-ohm coax video cables or cables that are manufactured specifically for SPDIF use.

— 8-pin port and cables —

WaveCenter/PCI's 8-pin port is for MIDI I/O. It connects to the MIDI breakout cable that's included with WaveCenter/PCI, providing four standard 5-pin MIDI connectors. Since MIDI inputs and outputs look the same, make sure you check the labels and connect your MIDI cables to the appropriate jacks.

Uninstalling WaveCenter/PCI

To uninstall WaveCenter/PCI, you need to remove the driver and control panel software, and remove the WaveCenter/PCI hardware.

— Removing the software —

1. Open the Windows Control Panel (Start→Settings→Control Panel), and double-click the System icon.
2. When the System window appears, select the “Device Manager” tab.
3. Click the ‘+’ next to “Sound, video, and game controllers” to open that part of the device tree.
4. Select “WaveCenter/PCI Wave and MIDI Driver,” and click ‘Remove.’
5. When prompted to “Confirm Device Removal,” click ‘OK’ to remove the driver software.
6. To remove the control panel software, open the Windows\System folder and delete the “WaveCenterPCI.cpl” file.

— Removing the hardware —

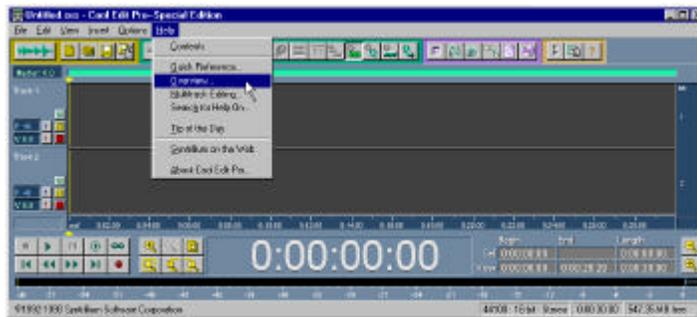
1. Make sure the computer is off (but leave its power cord plugged in), and then remove its cover.
2. Disconnect the internal CD-ROM cable from the WaveCenter/PCI board.
3. Remove the mounting screw that holds the WaveCenter/PCI bracket in the computer.
4. Lift the WaveCenter/PCI board straight out of its PCI slot.
5. Insert the plastic protective plugs into the two optical ports, and put the WaveCenter/PCI board into an antistatic bag.
6. Replace the blank metal bracket and the computer’s cover, and restart your computer.

≡ Tutorial ≡

This tutorial uses Cool Edit Pro SE to demonstrate some features of WaveCenter/PCI.

During installation, you probably created a Cool Edit Pro program group. If so, you can open the application from the Start menu (Start→Programs→Cool Edit Pro→Cool Edit Pro Special Edition).

If you haven't used Cool Edit Pro before, please become familiar with it first. To learn from its online documentation, select 'Overview...' from the Help menu, click the 'Contents' button and open a topic such as 'Getting Started' or 'Navigating Cool Edit Pro.'

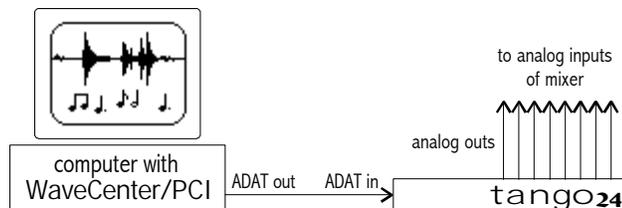


Preparing for Playback

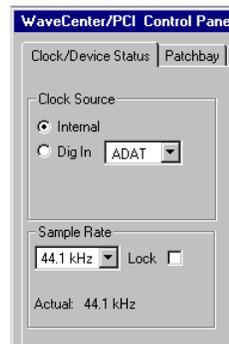
This tutorial assumes you're using Tango24 as a D/A converter for WaveCenter/PCI, but any external D/A converter can be used instead.

If you don't have a Tango24, see "Playback & Recording Devices" in the "Using WaveCenter" chapter for other setup suggestions. In all cases, the best setup for tutorial playback has WaveCenter/PCI as the sample clock master at 44.1 kHz, and the external device slaved to WaveCenter/PCI.

1. Connect an optical cable from WaveCenter/PCI's optical output to the Tango24 optical input.
2. Set the Tango24 clock switch (on the front panel) to 'Optical' so the Tango24 will be slaved to WaveCenter/PCI's optical output.
3. Make sure the Tango24 analog outputs are properly connected to your monitoring system.

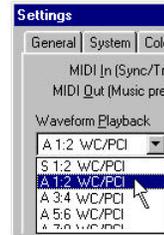


4. To open WaveCenter/PCI's control panel, double-click its icon in the Taskbar. (Or from the Start menu, navigate to Settings→Control Panel, and double-click on the "WaveCenterPCI" icon.)
5. In the WaveCenter/PCI control panel, make sure the Clock Source is set to 'Internal' (so WaveCenter/PCI is the sample clock master) and set the Sample Rate to '44.1 kHz.'



Playing a Sound

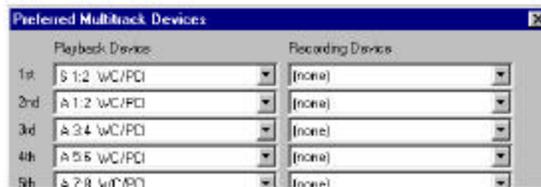
1. Open Cool Edit Pro SE (CEP) and make sure you're in the 'Edit Waveform' view. (F12 toggles between the 'Edit Waveform' and 'Multitrack' views.)
2. Go to Options→Settings... and open the Devices tab.
3. Set the 'Waveform Playback' field to the desired stereo output (for example, 'A 1:2 WC/PCI' to use WaveCenter/Tango24 outputs 1 & 2) and click 'OK.'
4. Open any sound file (.wav file) on your system. If you don't have a favorite sound file, you can go to File→Open... and navigate to C:\Windows\Media, where you should find 'The Microsoft Sound.wav'. When you double-click on the sound file, its waveform should appear in the CEP window.
5. Click the Play button (near the bottom left of the CEP window) to hear the sound.



When the sound is playing, the 'Clock/Device Status' tab in the WaveCenter/PCI control panel should show bright green status icons for digital outputs A 1:2.

Editing the Sound

1. In the CEP window, go to Edit→Select Entire Wave, and then Edit→Copy.
2. Click at the end of the waveform, and then go to Edit→Paste.
3. Go to View→Multitrack View, and then File→New Session... and make sure that 44100, Stereo, and 16-bit are selected. Click 'OK.'
4. Click near the beginning of Track 1 to indicate where you'll be inserting the edited waveform.
5. Go to the Insert menu and select the name of your file. Your edited waveform should appear on Track 1.
6. Go to Options→Device Preferences... and map the CEP Playback devices to WaveCenter/PCI, as shown here. Click 'OK.'



7. In the control area at the left of Track 1, click the grey button with the blue number on it to open the 'Playback Device' window.
8. Select the desired output device (for example, 'A 5:6 WC/PCI') and click 'OK.' (This is how you route tracks to WaveCenter/PCI output channels in CEP.)
9. Click the Play button to playback Track 1. You should hear the sound play twice.



Setting Up to Record

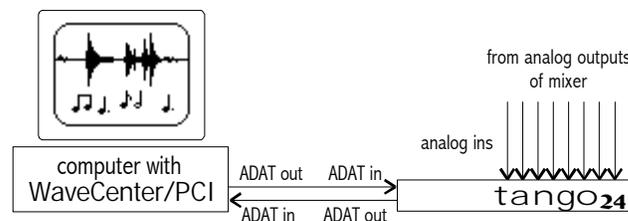
You can record additional tracks in your CEP session by transferring digital audio from an ADAT, DAT or CD player. Or you can record live audio through a digital mixer's analog inputs, an external A/D converter, or by using the A/D converters in an ADAT or DAT machine.

Note: If you only have one digital tape machine, you'll be able to record during this part of the tutorial, but without hearing the sounds recorded previously (because you can't simultaneously use the A/D and D/A converters in an ADAT or DAT machine). To record and play back simultaneously, you'll need two tape machines, a digital mixer, or an external converter such as Tango24 or Zulu.

This tutorial assumes you're using Tango24 as an A/D converter for WaveCenter/PCI, but any external A/D converter can be used instead.

If you don't have a Tango24, see "Playback & Recording Devices" in the "Using WaveCenter" chapter for other setup suggestions. In all cases, connect the external device's digital output to one of the WaveCenter/PCI audio inputs. During setup, look at the input status indicators (in the Clock/Device Status tab of the WaveCenter/PCI control panel) to verify that you're receiving proper digital input.

1. Connect the Tango24 optical output to WaveCenter/PCI's optical input.
2. Set the Tango24 clock switches to "Internal 44.1kHz" so Tango24 is the sample clock master.

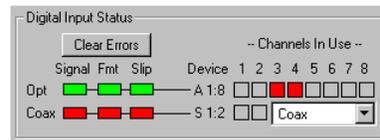


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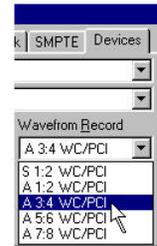
- In the 'Clock/Device Status' tab of the WaveCenter/PCI control panel, set the Clock Source to 'Dig In ADAT' so the computer is slaved to the Tango24 optical output.



- Verify that all three of WaveCenter/PCI's 'Opt' input indicators are green (meaning that the signal is present, it's the correct format, and WaveCenter/PCI's clock is locked to the input). If any indicator is red, refer to the "Software Reference" chapter later in this Guide.



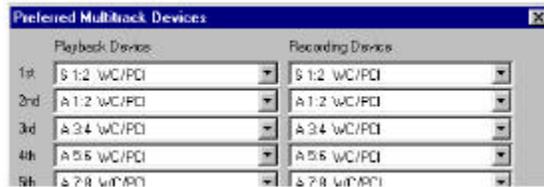
- In CEP, use F12 or the View menu to select 'Edit Waveform' view. (We'll use 'Edit Waveform' view to check the input level, and then we'll use 'Multitrack' view to actually record.)
- Go to Options→Settings...→Devices, set the 'Waveform Record' field to the appropriate input (for example, 'A 3:4 WC/PCI' to use Tango24/WaveCenter inputs 3 & 4), and click 'OK.'



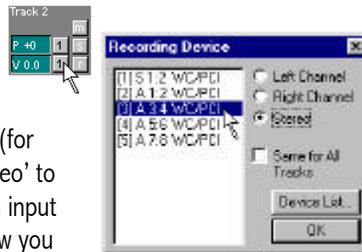
- Open the View menu and make sure 'View Level Meters' is checked.
- Right-click on the horizontal meters (at the bottom of the CEP window) and select 'Start/Stop Meter' from the pop-up menu.
- Connect the instrument or microphone to the appropriate input, and adjust the input level so it's hot without clipping. When the level is set, select 'Start/Stop Meter' again or click the Stop button to turn off metering.

Recording a Track

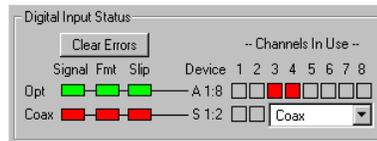
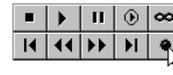
1. Use F12 or the View menu to select 'Multitrack' view.
2. Go to Options→Device Preferences... and map the WaveCenter/PCI inputs to the CEP Recording devices, as shown here. Click 'OK.'



3. Click the Track 2 grey button with the red number on it to open the 'Recording Device' window.
4. Select the appropriate input device (for example, 'A 3:4 WC/PCI'), click 'Stereo' to indicate that we'll be recording both input channels, and click 'OK.' (This is how you route inputs to tracks in CEP.)



5. To record-enable Track 2, click its red 'r' button.
6. Click the Record button (near the bottom left of the CEP window) to begin recording, and play the tape or perform live. While recording, the input status icons for ADAT channels 3:4 in WaveCenter/PCI's control panel should be bright red, and you should also hear the audio on Track 1.



7. Click the Stop button when you finish recording. In a moment, the new waveform should appear on Track 2.
8. To disable recording on Track 2, click its red 'r' button again.

≡ Using WaveCenter/PCI ≡

This chapter includes information about using WaveCenter/PCI with other devices for recording and playback.

Synchronization

Every digital audio system operates at a particular sample rate, such as 44,100 samples per second (44.1kHz) for CDs. The sample rate can be explicitly transmitted between devices (using BNC word clock, for example) or it can be embedded in a digital audio stream that uses a self-clocking format (ADAT optical, SPDIF, or AES/EBU). The sample rate can also be derived from NTSC or PAL video signals.

When two or more digital audio devices transfer data, one and only one of them should be used to set the sample rate. This device can have a variety of names — system clock source, sync source, sample clock master, audio clock master, or word clock source. The master device uses an internal oscillator to set the sample rate. All other devices must be synchronized (slaved) to the sample clock master, so their digital clocks are locked to the master clock.

No two oscillators run at exactly the same rate, even if they're both 44.1kHz oscillators (for example). Therefore, if two devices in a system are set to internal sync, each using its own internal oscillator, one is inevitably a bit faster than the other. As a result, samples are lost or duplicated during the transfer, corrupting the audio.

REMEMBER! Any digital audio system must always have exactly one sample clock master, which should determine the sample rate for all devices in that system. If the sample rates don't match, you'll hear glitches, dropouts, or nothing at all.

When one device (the slave) gets its sample rate from another device (the master), we say that the slave device is locked to the master. In contrast, when two devices are operating at independent sample rates, they are slipping relative to each other. When multiple sample rates are detected, some devices mute, some generate clicks and pops, and some exhibit completely erratic behavior.

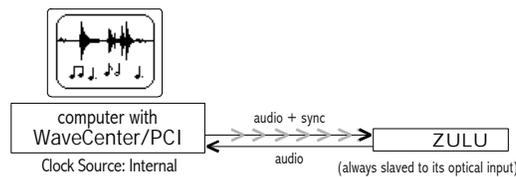
Some devices (such as DVD and CD-ROM drives, and most DAT machines) are automatically set to “Internal” sync, and therefore must be the master device. To transfer audio between the computer and a DAT machine, DVD or CD-ROM drive, set the WaveCenter/PCI clock source to “Dig In SPDIF.”

Some devices (such as Frontier Design’s Zulu) must always be slaved to another device. So if you’re using WaveCenter/PCI with Zulu, set the WaveCenter/PCI clock source to “Internal.” Other devices (such as Frontier Design’s Tango24 and WaveCenter/PCI) can be either the master or a slave.

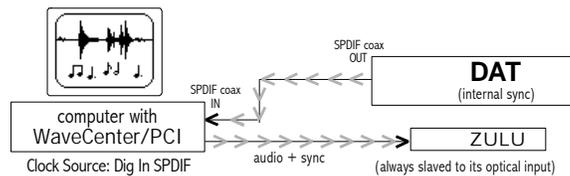
Illustrations

The following illustrations show some synchronization settings that work well, and two examples that don’t work. In each usable system, exactly one device is set to “Internal” sync, and all other devices are slaved to that device.

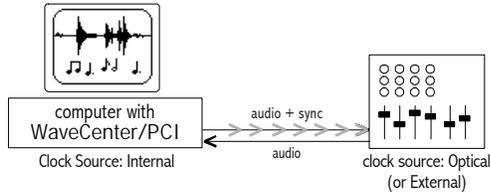
Example 1: WaveCenter/PCI is the master;
Zulu is slaved to WaveCenter/PCI.



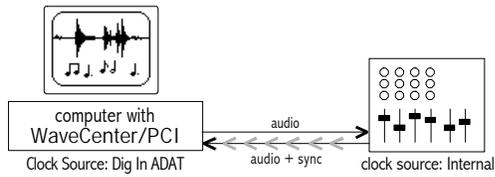
Example 2: The DAT machine is the master;
Zulu is slaved to WaveCenter/PCI, which is slaved to the DAT machine.



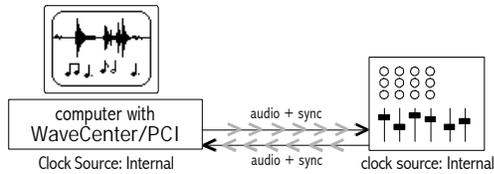
Example 3: WaveCenter/PCI is the master;
the digital mixer is slaved to WaveCenter/PCI.



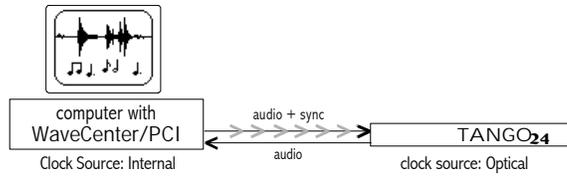
Example 4: the digital mixer is the master;
WaveCenter/PCI is slaved to the digital mixer.



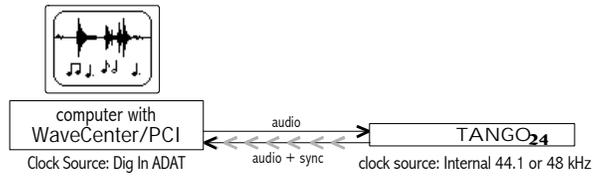
Example 5: This example does NOT work because
both devices are set to "Internal" (there are too many masters).



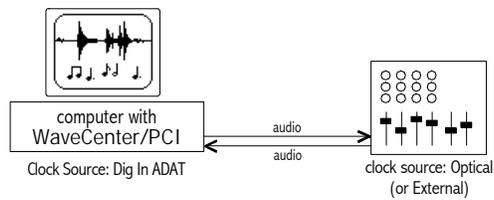
Example 6: WaveCenter/PCI is the master; Tango24 is slaved to WaveCenter/PCI.



Example 7: Tango24 is the master; WaveCenter/PCI is slaved to Tango24.



Example 8: This example does NOT work because each device expects sync signals from the other device (there is no master).



Playback & Recording Devices

You can use a variety of devices to play through WaveCenter/PCI's outputs and record through its inputs. Here are some general guidelines for several types of external devices — digital mixers, external converters, ADAT-compatible multitrack decks, DAT machines, and DVD or CD-ROM drives.

See “Synchronization” earlier in this chapter for more details about clock sources and sample rates.

— Digital Mixers —

For playback from WaveCenter/PCI, it's best to slave the digital mixer to WaveCenter/PCI. Although some digital mixers prefer to be the sample clock master device, all have a menu option that lets the mixer be slaved to one of its digital inputs.

For recording into WaveCenter/PCI, digital mixers can digitize mic-level or line-level inputs, and route them directly to mixer outputs that are connected to WaveCenter/PCI inputs. You can use the mixer to add EQ or effects, and create submixes before recording.

In each case, make sure you route the appropriate channels to the appropriate outputs, with sufficient level on each channel. Most mixers have internal metering to help you verify the signal path and levels.

— External Converters —

If you're using Frontier's Tango24 or Zulu converters, you'll need to select ADAT pairs (A 1:2, A 3:4, A 5:6, A 7:8) as the playback and recording devices in your audio applications (Cool Edit Pro, Cakewalk, Cubase, and so on). If you're using a 2-channel external converter instead, make sure you select SPDIF (S 1:2 rather than an ADAT pair) as the playback and recording devices in your audio applications.

Since Zulu must always be slaved to its optical input, leave the WaveCenter/PCI clock source set to “Internal” regardless of whether you're using Zulu for playback or recording.

— ADAT-Compatible Multitrack Decks —

To use an Alesis, Panasonic or Fostex multitrack deck as a D/A converter (for playback from WaveCenter/PCI), set it to 'All Input' monitoring, 'Digital' input, and 'Dig 44.1kHz' clock source. On an original (black faceplate) ADAT machine, enabling 'Digital In' automatically sets the clock source to its optical/digital input. On an ADAT-XT, use the Clock Select button to choose 'Dig 44.1kHz.'

To use an Alesis, Panasonic or Fostex multitrack deck as an A/D converter (for recording into WaveCenter/PCI), set it to 'All Input' monitoring, 'Analog' input, and 'Int 44.1kHz' clock source. An original (black faceplate) ADAT machine automatically switches to internal sync when its 'Digital In' button is off. If you're using a BRC or an original ADAT machine, you set the clock to 44.1kHz by pitching down to '-147 cents.'

Note: Unlike Tango24 or Zulu, you cannot simultaneously use both the A/D and D/A converters in an ADAT-compatible multitrack deck. To play and record simultaneously, you'll need to use separate external playback and recording devices.

— DAT Machines —

To use a DAT machine as a D/A converter (for playback from WaveCenter/PCI), set its input source to 'Digital' and enable its 'Record-Pause' mode to monitor the digital inputs. In your audio application, make sure you select SPDIF (S 1:2 rather than an ADAT pair) as the playback device.

To use a DAT machine as an A/D converter (for recording into WaveCenter/PCI), set its input source to 'Analog' and enable its 'Record-Pause' mode to monitor the analog inputs. In your audio application, make sure you select SPDIF (S 1:2 rather than an ADAT pair) as the recording device.

The input monitoring function works better on some DAT machines than on others. To enable input monitoring, a DAT may:

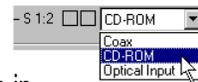
- not need to have a tape loaded (ideal)
- need to have a tape loaded, but not need to spin up its head (OK)
- need to have a tape loaded, and need to spin up its head (unfortunate)

The last case is particularly undesirable because the spinning head will unnecessarily wear both the tape and head. If you're considering purchasing a DAT machine, ask whether it must have a tape loaded and whether it needs to spin up its head to enable input monitoring.

Note: Unlike Tango24 or Zulu, you cannot simultaneously use both the A/D and D/A converters in a DAT machine. To play and record simultaneously, you'll need to use separate external playback and recording devices.

— DVD and CD-ROM Drives —

Some DVD and CD-ROM drives have a 2-pin digital audio output. If you connected such a drive in your WaveCenter/PCI installation, you can select it as the 'S 1:2' input in the Clock/Device Status tab of the WaveCenter/PCI control panel.



Since the drive cannot synchronize to an external sample rate, it must be the master device. Therefore, to record into WaveCenter/PCI from a DVD or CD-ROM drive, you also need to set the WaveCenter/PCI clock source to 'Dig In SPDIF.'

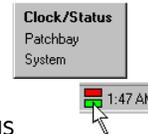
If you also want to monitor the input while recording, open the WaveCenter/PCI Patchbay tab and route the SPDIF inputs to the desired optical or coax (SPDIF) outputs.

Some CD-ROM drives only have active output if an audio CD is loaded and playing in the drive, so make sure a CD is actually counting playback time before checking the input status indicators in the WaveCenter/PCI control panel.

Some audio applications include CD transport controls. For example, Cool Edit Pro lets you select "Show CD Player" from the View menu.

≡ Software Reference ≡

Whenever WaveCenter/PCI is installed in your system, an icon with two bars appears in the Windows Taskbar (usually at the bottom of the screen). The top bar lights red whenever any WaveCenter/PCI input is active, and blinks whenever an active input has an error (see the “Clock/Device Status Tab” section for details about input errors). The bottom bar lights green whenever any WaveCenter/PCI output is active.



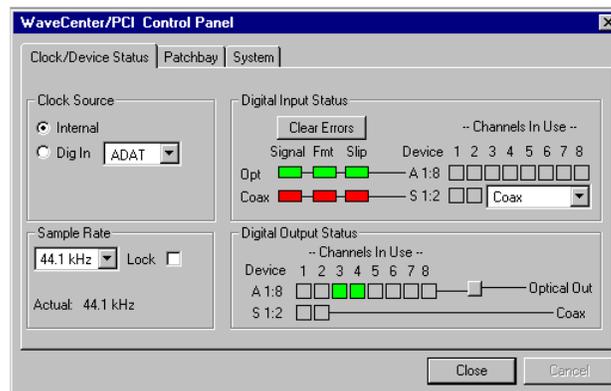
Double-clicking on the icon opens the Clock/Device Status tab. You can also right-click on the icon to display a menu that lets you go directly to the Clock/Status, Patchbay, or System tab.

To open WaveCenter/PCI’s control panel from the Start menu, navigate to Settings→Control Panel, and double-click on the “WaveCenterPCI” icon.

The control panel includes three tabs — Clock/Device Status, Patchbay, and System. Each tab contains several sections, each with one or more fields.

Clock/Device Status Tab

The Clock/Device Status tab contains four sections — Clock Source, Sample Rate, Digital Input Status, Digital Output Status.



— Clock Source —

The audio clock can come from one of three sources.



Internal With this setting, the computer is the sample clock master, running at either 44.1 or 48kHz, depending on the Sample Rate selection

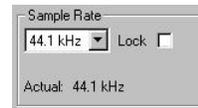
Dig In ADAT With this setting, the 8-channel ADAT device connected to WaveCenter/PCI's optical input is the sample clock master.

Dig In S/PDIF With this setting, the stereo SPDIF device (connected to the coax, optical or CD-ROM input) is the sample clock master.

For more information about audio clocks and sample rates, see 'Synchronization' later in this chapter.

— Sample Rate —

In this section, a drop-down box lets you select the expected sample rate (44.1 or 48kHz). If the 'Lock' box is checked, then applications can only use that sample rate. For example, if the sample rate is locked at 48kHz and you try to play a 44.1kHz sound, an error message appears (though it may not clearly state that the sample rate is incorrect). The Sample Rate section also displays the actual current sample rate as measured by the computer.



— Digital Input Status —

This section displays the audio input status in the form of error indicators, mappings from physical inputs to logical inputs, and channel indicators.

On the left are three rectangular error indicators for each of WaveCenter/PCI's physical inputs (Opt and Coax).

A red indicator represents an error, and green means "good to go." A slash across a green indicator means that at least one error was detected since the errors were last cleared. To remove all slashes, click 'Clear Errors.'



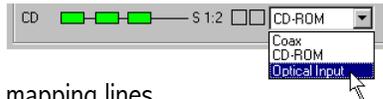
From left to right, the indicators are:

- Signal green = input signal active
red = input signal inactive
- Format (Fmt) green = valid digital audio format detected
red = error in digital audio signal format
(for example, feeding an SPDIF signal to an ADAT input)
- Slip green = WaveCenter/PCI is locked to incoming audio clock
red = WaveCenter/PCI's sample rate is different than the incoming audio clock

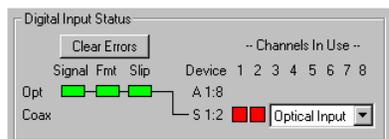
If WaveCenter/PCI's sample rate is almost the same as the incoming audio clock, but not perfectly locked, the Slip indicator flashes red periodically. A slash appears across the green indicator until you click 'Clear Errors.'

By default, the physical inputs (Opt and Coax) are mapped directly to the logical devices (A 1:2, A 3:4, A 5:6, A 7:8, and S 1:2) that you'll use within your recording/playback applications.

The stereo device 'S 1:2' (in SPDIF format) can come from any physical input — the optical input, the RCA (coax) input, or the internal DVD/CD-ROM 2-pin connector. You can select the stereo input device from the drop-down box next to 'S 1:2.'



The physical-to-logical mapping lines automatically change to graphically reflect your selection.



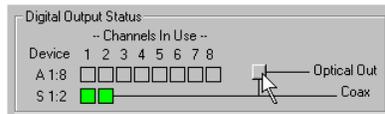
The 'Channels In Use' indicators show activity on each input channel. If an input channel is in use, its indicator is bright red.

— Digital Output Status —

This section shows which output channels are active, and the mapping from logical output devices to physical outputs. When an output channel is playing data, its indicator is bright green.



The stereo SPDIF stream is always present on WaveCenter/PCI's RCA (coax) output. You can also route the SPDIF stream to the optical output. Clicking on the button next to Optical Out toggles the optical output between 8-channel mode (ADAT optical) and 2-channel mode (SPDIF optical).

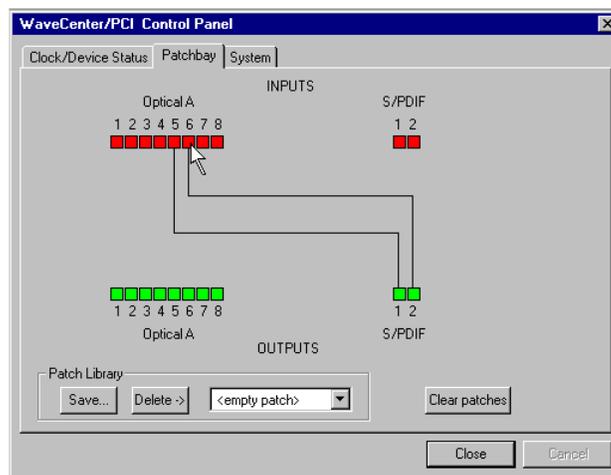


The logical-to-physical mapping lines automatically change to graphically reflect your selection.

Patchbay Tab

The Patchbay tab lets you route any of WaveCenter/PCI's audio inputs to any of its audio outputs. You can use the Patchbay tab both for input monitoring and for real-time digital audio format conversions.

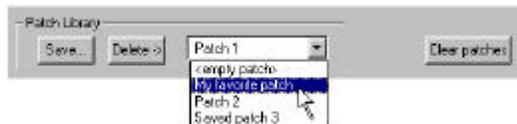
For example, you can monitor WaveCenter/PCI's "Optical A 5:6" inputs through the SPDIF coax outputs, as shown here.



WaveCenter/PCI inputs appear in the top row of icons; outputs appear in the bottom row. To create a patch, click on an input icon and then click on an output icon, or drag the cursor from an input to an output. Lines automatically appear to indicate the routing(s).

To delete a particular routing, double-click on its input or output icon. To undo all the current routings, click the "Clear patches" button.

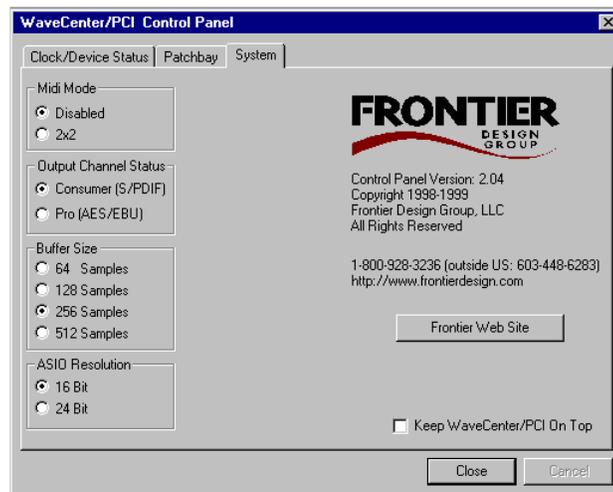
To save the current routings in the Patch Library, click "Save..." and type a name for the patch. You can then restore those routings by selecting the saved patch from the drop-down box.



To remove a saved patch from the Library, select the patch in the drop-down box and then click the "Delete" button.

System Tab

In addition to displaying the WaveCenter/PCI software version and contact information for Frontier Design Group, the System tab lets you enable the MIDI ports and set other options.



Clicking the 'Frontier Web Site' button launches access to our web site if your PC has an internet link and web browser.

The System tab also has a checkbox labelled "Keep WaveCenter/PCI On Top." When the box is checked, the control panel remains in front of other windows on your screen.

— MIDI Mode —

In order to avoid a Windows 95 limitation (see warning below), WaveCenter/PCI ships with its MIDI ports disabled.

This MIDI limitation is not a problem in Windows 98.

WARNING! Windows 95 is limited to a maximum of 11 MIDI input ports and 11 MIDI output ports. Adding WaveCenter/PCI's MIDI ports may put your system beyond the limit, causing it to crash with the "blue screen" message "MSGSRV32 caused a general protection fault...".

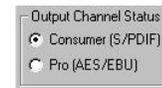
There is no easy way to recover from this crash, so before enabling MIDI ports in the WaveCenter/PCI control panel, make sure your Windows 95 system doesn't already have 9 other MIDI ports enabled.

To enable WaveCenter/PCI's MIDI ports, set the MIDI mode to '2x2' and then reboot the computer. To disable the MIDI ports, set the MIDI mode to 'Disabled' and then reboot the computer.



— Output Channel Status —

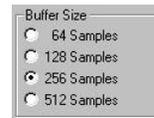
The Output Channel Status section lets you set the channel status bits for WaveCenter/PCI's stereo outputs to either Consumer (SPDIF) or Pro (AES/EBU). The default is SPDIF.



If you have an external SPDIF-to-AES/EBU level converter such as the Hosa CDL-313, you can use it with WaveCenter/PCI's Pro (AES/EBU) setting to generate true AES/EBU output.

— Buffer Size —

The Buffer Size indicates how often data is processed between the WaveCenter/PCI hardware and its driver.



Smaller buffer sizes yield faster response times (lower latency), which most noticeably affect audio functions such as monitoring inputs in the Patchbay or using WaveCenter/PCI's ASIO driver in Cubase VST. Larger buffer sizes provide more protection against audio glitches. The default setting is 256 samples. We recommend that you set the buffer size as large as possible while attaining suitable latency for your audio.

Note: You must close all audio applications before you change WaveCenter/PCI's buffer size. The new setting takes effect when you restart the application(s).

— ASIO Resolution —

You can set the resolution for recording and playback to '16 bit' or '24 bit' when using WaveCenter/PCI's ASIO driver in applications such as Cubase VST. You may also need to set the resolution in the application itself. For example, to record and play 24-bit audio in Cubase VST, you have to enable its '24-bit' button.



Note: You must close all audio applications that use the ASIO driver before you change WaveCenter/PCI's ASIO resolution. The new setting takes effect when you restart the application(s).

ASIO Driver

WaveCenter/PCI's ASIO driver provides ultra-low latency for real-time audio functions such as input monitoring and adjusting EQ, pan, and other parameters in audio applications that utilize ASIO drivers.

To use WaveCenter/PCI's ASIO driver in Cubase VST:

1. Close Cubase VST, and open the System tab of WaveCenter/PCI's control panel.
2. Select the desired Buffer Size and ASIO Resolution settings (described on the previous page).
3. Open Cubase VST, and select "System..." from the Audio menu.
4. In the 'Audio I/O' section of the Audio System Setup window, set the 'ASIO Device' field to "ASIO WaveCenter/PCI Driver."



5. Verify that the sample rate, audio source, number of channels, and other options are correct. You can try different disk block buffer sizes in Cubase VST to improve performance (ie, the number of tracks).
6. Click "OK" to close the Setup window.

Note: To actually record or play 24-bit audio, you must set WaveCenter/PCI's ASIO Resolution to '24 Bit' (in step 2) and you also need to enable the '24-bit' button in Cubase VST.

≡Troubleshooting ≡

This section describes some possible problems, and suggestions for resolving them.

You can also check our web site (<http://www.frontierdesign.com>) for driver updates and application notes.

Problems	Possible Solutions
Just installed WaveCenter/PCI and it doesn't work	<p>There's probably an IRQ conflict. If so, the channel output status icons (on the Clock/Device tab of the WaveCenter/PCI control panel) will be dark green rather than bright green when you try to play a sound.</p> <p>WaveCenter/PCI is designed properly for IRQ sharing, but some other devices aren't. You can resolve the problem by moving WaveCenter/PCI to a different IRQ — power down the computer, move the WaveCenter/PCI card to a different PCI slot, and then reboot the computer.</p>
No MIDI in/out	<p>WaveCenter/PCI's MIDI ports are disabled by default. To enable the MIDI ports, open the System tab of the WaveCenter/PCI control panel, and select MIDI 2x2.</p>
Can't get audio from DVD or CD-ROM	<p>Verify that the drive has a fully-functional 2-pin digital audio output, and that the cable is properly connected from that output to WaveCenter/PCI's internal CD-ROM connector.</p> <p>In the Clock/Device Status tab of the WaveCenter/PCI control panel, set the "S 1:2" device to CD-ROM, and set the clock source to Dig In SPDIF.</p> <p>Some CD-ROM drives only have active output if an audio CD is loaded and playing in the drive. Verify that the drive is spinning and actually counting playback time.</p>

Problems	Possible Solutions
No audio output (can't hear any audio playback)	<p>Verify that the playback device selected in your application corresponds to the WaveCenter/PCI output you're using.</p> <p>Check the analog signal path to make sure the signal gets to your headphones/speakers.</p> <p>If the output "Channels In Use" icons are dark green (rather than bright green), there's probably an IRQ conflict. Power down the computer, move the WaveCenter/PCI card to a different PCI slot, and reboot the computer.</p>
No audio input (can't record audio)	<p>Verify that the record device selected in your application corresponds to the WaveCenter/PCI input you're using.</p> <p>Check the Input Status icons in the Clock/Device Status tab of the WaveCenter/PCI control panel —</p> <p>SIGNAL: If "Signal" is red, verify that the cable is properly connected from the output of the source device to the WaveCenter/PCI input, and that the source device is actually playing audio.</p> <p>FMT: If "Fmt" is red, the digital audio input format doesn't match the selected WaveCenter/PCI input. On the Clock/Device tab, make sure the settings in the "Digital Input Status" section match the actual input you're using. There are four options —</p> <ul style="list-style-type: none"> • To record through the RCA (coax) input, set 'S 1:2' to Coax. • To record from a CD-ROM or DVD, set 'S 1:2' to CD-ROM. • To record stereo SPDIF audio through the optical input (from a DAT machine or minidisc, for example), set 'S 1:2' to Optical. • To record 8-channel ADAT audio through the optical input (from a digital mixer or an ADAT-compatible multitrack, for example), set 'S 1:2' to Coax (not Optical). <p>SLIP: If "Slip" is red, check the clock source settings. Verify that one (and only one) device is set to "Internal" and that all other devices are slaved to that device. Some devices (CD-ROM and DVD drives, and most DAT machines) are automatically set to "Internal" sync, so to record from one of them, you need to set the WaveCenter/PCI clock source to Dig In SPDIF.</p> <p>See the "Using WaveCenter/PCI" and "Software Reference" chapters earlier in this guide for more details.</p>

≡ Tuning the System ≡

Because Windows 95 and Windows 98 are general purpose operating systems, some of the default system settings may not be optimal for digital audio work. This chapter offers suggestions that may help improve the performance of your system.

Please check your audio application's documentation for additional performance tips. If you have Internet access, you may want to periodically check your software manufacturer's web site in addition to ours (<http://www.frontierdesign.com>) for updated information.

Disk Drives

Whenever possible, use a large, fast, separate disk for storing your digital audio. Digital audio consumes a lot of disk space. For example, 5 minutes of an 8-channel, 44.1kHz, 16-bit recording consumes about 212 MB on your hard disk. With disk prices decreasing all the time, large disks are quite affordable. Nevertheless, you need to be sure your disk has enough room for your projects. You may need to archive older projects to tape or removable disks.

The number of tracks that your software will be able to transfer in real time depends on the speed of your hard disk subsystem (and your CPU, of course). The disk subsystem that comes with many desktop systems should be fine in most cases but for the best performance, consider a PCI-based Wide UltraSCSI adapter and "AV" (audio-visual) rated disk drives with at least 7200rpm spindle rates.

Use a separate disk drive for your audio. By keeping your programs, virtual memory swapfile, and any disk caches on a different drive, you keep the disk activity associated with those operations separate from the continuous reading and writing of audio data. This should result in less head movement and higher overall throughput for your audio.

Disk Fragmentation

We recommend that you defragment your disk regularly, especially after heavy editing sessions. Defragmenting reorganizes files into contiguous areas on the disk, so that the entire file can be accessed with a minimum number of head movements. One strategy is to leave the PC running and defragment the disk at the end of each day.

Data Compression

Don't use data compression on the drive that stores your digital audio. Although Windows 95/98 supports data compression (for example, the DriveSpace utility that comes with Microsoft's "Plus!" add-ons for Windows 95), the compression algorithms generally don't work well with digital audio. Furthermore, because the CPU spends time compressing and uncompressing your files, fewer CPU cycles are available for mixing tracks in your audio application.

Sporadic Disk Activity

Some applications think they're doing you a big favor by hanging around in the background until the last crucial 10 seconds of your mixdown, when they awaken and start pounding your disk.

Avoid applications and utilities that cause sporadic disk activity, such as System Agent, Find Fast for Office, Screen Savers, and CD-ROM "Auto-Insert" Notification. Here are some suggestions for thwarting them.

— System Agent —

System Agent (included in the Microsoft Windows add-on) includes utilities that scan your disk for errors and perform disk defragmentation. System Agent allows you to schedule these activities so they occur at specific times or when you haven't used your computer for a period of time. To prevent these disk-intensive activities from occurring, we recommend that you either disable System Agent while doing your audio work (right-click its icon in the system tray of the Task Bar), or schedule the activities to occur when you're absolutely sure that you won't be trying to record and play audio.

— Find Fast for Office —

If you use Microsoft's Office products (Word, Excel, PowerPoint, Schedule, or Access), the "Find Fast" utility was probably installed in the Windows Control Panel. The utility periodically scans your disks, building indices of all your Office documents so their names can be displayed quickly. Unfortunately, the indexing activity could pound your disks while you're trying to play back a multitrack recording.

To prevent Find Fast from running, you can either remove it permanently or disable it temporarily while you work on audio.

- To disable Find Fast permanently, open the Windows "Startup" folder and delete "Microsoft Office Find Fast Indexer." (You can use Windows Explorer to navigate to "C:\Windows\Start Menu\Programs\StartUp.")
- To disable Find Fast temporarily, open the Windows Control Panel (Start→Settings→Control Panel) and double-click the Find Fast icon. When the Find Fast window appears, select 'Pause Indexing' from the Index menu. When you want to enable Find Fast, select 'Pause Indexing' again.

— Screen Savers —

Few things are worse than having your audio interrupted by the sudden appearance of a bunch of flying toasters (or some other screen saver). A screen saver is particularly vexing because its delay timer silently ticks away when you're not touching your mouse or keyboard (when you're printing your final mix to DAT, for example).

To disable the screen saver, consult its documentation, or try this procedure: open the Windows Control Panel, double-click the Display icon, select the "Screen Saver" tab, and click the down arrow next to the "Screen Saver" box. Select 'None' (the first entry) and then click 'OK' to confirm the selection.

— CD-ROM "Auto-Insert" Notification —

When this option is enabled, Windows may periodically poll your CD-ROM drive to see if you've changed CD's, causing the CD-ROM access light to blink about every five seconds. If Windows Explorer is open and detects a new CD, you'll experience a flurry of disk and CPU activity while the folder and filenames of the new CD are updated in the display. The CPU activity may cause dropouts in your audio.

If you don't load a CD during audio operations, you may not experience this problem, but it's a nice opportunity to rid your machine of that annoying flashing LED!

1. Open the Windows Control Panel (Start→Settings→Control Panel), and double-click the System icon.
2. When the "System Properties" dialog box appears, click the "Device Manager" tab and then click '+' to open the "CD-ROM" sub-tree. A list of installed CD-ROM drives appears (there may be only one in the list).
3. Double-click the line that describes your particular model of CD-ROM ("NEC CDR-74" for example).
4. When the "Properties" dialog box appears, click the "Settings" tab and uncheck 'Auto insert notification.'
5. Click 'OK' to confirm the change, and then close the Control Panel.

Multi-tasking

Windows 95/98 can run many applications at once, but if you run more than one at a time, the performance of each individual application diminishes. Your audio applications are particularly heavy users of CPU cycles and disk bandwidth, so it's important to minimize the use of other high-demand applications. It's probably OK to run a word processor in the background while you're mixing down, but avoid applications that do a lot of computation or frequently access the hard disk.

File Caching

Windows 95/98 has built-in file caching which saves your most recently accessed data in memory. Since file caching is of limited use in digital audio applications, you may want to restrict the amount of memory reserved for file caching. Locate the SYSTEM.INI file in your Windows folder, and open the file in a text editor such as Notepad. Create (or find and edit) a section named "[VCache]" and make sure the MinFileCache and MaxFileCache are both set to:

4096 (for a computer with 32MB of RAM), -or-
8192 (for a computer with 64MB or more of RAM)

The values are given in kilobytes (KB) of RAM (2048 means 2MB of RAM).

WARNING! Do not use values for MinFileCache or MaxFileCache that begin to approach the amount of physical RAM in your machine. NEVER use values greater than the old Windows 3.1 limit of 24576 (24 MB). Microsoft specifically warns that it does not guarantee performance of the cache at sizes larger than this and disavows responsibility for data corruption or loss that may occur. So do we!

Other Caching Options

There are several other caching options which may affect your PC's audio performance —

- You may want to limit the amount of “Read-ahead optimization” performed by Windows. Open the Control Panel (Start→Settings→Control Panel), and double-click the System icon. Select the “Performance” tab, and click the ‘File System...’ button. When the “File System Properties” dialog appears, select the “Hard Disk” tab, and move the ‘Read-ahead optimization’ slider all the way to the left.
- In the same dialog (“File System Properties”), you can specify the “Typical role of this machine.” In most cases, you'll want it set to ‘Desktop computer.’
- You may want to disable “write-behind caching.” In the “File System Properties” dialog, select the “Troubleshooting” tab and check the box labelled ‘Disable write-behind caching for all drives.’

Virtual Memory Swapfile

When the demands of multi-tasking exceed the limits of physical memory on your machine, Windows dynamically changes the size of the swapfile that it uses to hold code and data. You can improve audio performance by setting the swapfile parameters manually.

Open the Control Panel, double-click the System icon, select the “Performance” tab in the System Properties dialog, and click the “Virtual Memory...” button. When the “Virtual Memory” dialog appears, select “Let me specify my own virtual memory settings.”

Set the following parameters in the dialog:

Hard disk: choose a disk other than the one you use for digital audio
(if possible)

Minimum: set it to 2.0–2.5 times the size of your system memory

Maximum: set it to the same value you specified for minimum

Leave “Disable virtual memory” unchecked!
(Otherwise, Windows displays a warning.)

Click “OK” to confirm your choices, and close the Control Panel. After changing this setting, you’ll be reminded that the new settings won’t take effect until you restart Windows.

Graphics Acceleration

If you experience glitches during recording or playback, you may have a video driver problem. If so, try reducing the amount of graphics acceleration used by Windows. Open the Control Panel, double-click the System icon, select the “Performance” tab in the System Properties dialog, and click the “Graphics...” button. When the “Advanced Graphics Settings” dialog appears, move the “Hardware acceleration” slider all the way to the left. Click “OK” to confirm the setting, and close the Control Panel. After changing this setting, you’ll be reminded that the new settings won’t take effect until you restart Windows.

After you’ve rebooted, see if the glitching problem is gone. If so, you may want to experiment with other settings of the “Hardware acceleration” slider to regain some of the graphics performance.

32-bit Drivers

To obtain the best possible performance from your disk system, use 32-bit drivers. Generally, the Windows installation replaces real-mode drivers with 32-bit protected mode drivers. However, there may not have been any 32-bit drivers that were compatible with your hardware when Windows was released. To check the driver, open the Control Panel, double-click the System icon and select the “Performance” tab. If the “File System” status doesn’t indicate “32-bit,” contact the manufacturer of your disk controller to get a 32-bit protected mode driver and install it in your system.

Windows System Monitor

Windows includes a “System Monitor” utility that displays important performance information about your machine. If it’s installed, you can usually find it by following this path in the Start menu:

Start→Programs→Accessories→System Tools→System Monitor

What if you don’t have System Monitor?

System Monitor is optionally installed as part of Windows 95/98, but every Windows 95/98 PC can load it. Open the “Add/Remove Programs” control panel (Start→Settings→Control Panels→Add/Remove Programs). In the “Windows Setup” tab, scroll down and select “Accessories.” Its check box will be gray if some of the accessories aren’t installed. Click the ‘Details...’ button. Scroll through the list of programs and make sure “System Monitor” is checked. Click ‘OK’ and follow the installation instructions.

When the WaveCenter/PCI driver is loaded, it notifies Windows that it can collect statistics that indicate how well the system is responding to WaveCenter/PCI’s requests to read and write audio data.

You can display these statistics and compare them with other important performance data —

1. Start the System Monitor application (Start→Programs→Accessories→System Tools→System Monitor).
2. Click on the fourth icon in the tool bar (it looks like a funky blue mountain range) so that data will be displayed in “time-line” format.
3. Select “Add Item...” from the Edit menu.
4. In the “Category” box, click ‘WaveCenter/PCI Performance.’ The list on the right indicates which performance data can be displayed.
5. Select one or more items from the list and click ‘OK.’ The graphical display adds the statistics you selected. You may also want to select items from other parts of the system so you can correlate the performance of WaveCenter/PCI with other CPU and disk activity.

The following list describes the available statistics.

— IRQ Latency —

This statistic indicates the maximum number of audio samples that have elapsed between the time the WaveCenter/PCI hardware asked for service and the time Windows began to process the request. Typically it's less than 5.

Correlating the system's response time to interrupts with other system activity will help you determine if there are other installed devices that prevent WaveCenter/PCI from being serviced efficiently. To calculate the absolute latency (accurate to within one sample), divide the IRQ latency by the current sample rate.

— IRQ Misses —

Normally, this should be zero. An IRQ miss means the WaveCenter/PCI driver wasn't given enough time to transfer audio between your PC and the WaveCenter/PCI hardware, a severe problem indicating that something in the system is causing gross timing latencies that can't be overcome. The result can be brief audio dropouts or pops. Try to determine whether another device is active when the IRQ misses occur, and then correct the situation by removing that device or by not using it while also trying to transfer audio.

— Input Overruns —

This indicates how many errors occurred when WaveCenter/PCI was ready to transfer newly-recorded information to an application, but the application hadn't supplied a buffer in which to write the audio data. Input overruns are generally caused by an overloaded CPU or a disk system that can't keep up with the audio applications.

— Output Underruns —

This indicates the number of times that the driver ran out of data to send to the digital audio outputs. Generally, it means that the CPU or disk system couldn't keep up with the real-time demands of the application. It's normal to see a "blip" when playback stops, but an output underrun in the middle of playback indicates a problem.

≡ WaveCenter/PCI Specifications ≡

These specifications are subject to revision without notice.

Digital audio inputs	8 channels ADAT optical format (1 TOSLINK optical port) 2 channels SPDIF format from CD-ROM digital output, or TOSLINK optical port, or RCA (coax) port
Digital audio outputs	8 channels ADAT optical format (1 TOSLINK optical port) 2 channels SPDIF format on the TOSLINK optical output and on the RCA (coax) output
MIDI I/O	2 MIDI inputs + 2 MIDI outputs; standard DIN-5 connectors via breakout cable connected to miniDIN-8 port
Sample rates	44.1 and 48 kHz internal, input tracking from 39–51 kHz, Real-time resampling to support 8, 11.025, 16, 22.05, and 32 kHz output streams
Audio data	8, 16, 20, 24 bit resolution
Software	Windows 95/98 device driver (MME, ASIO, GigaSampler) Control panel for displaying status and setting options
System requirements	1 PCI slot and 1 IRQ
Dimensions	4.7" x 3.4" (12cm x 8.6cm), PCI short card

Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the User's Guide, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

The user is cautioned that changes and modifications made to the equipment without the approval of manufacturer could void the user's authority to operate this equipment.

Declaration of Conformity

Frontier Design Group, LLC declares that the multichannel digital I/O card called WaveCenter/PCI conforms to the following Directives and Standards:

Council Directives: 89/336/EEC, 73/23/EEC
Conformance Standards: EN55022 Class B, EN50082-1

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