

DESCRIPTION
REAL COMPETENCE

PHASE 88 RACK

24 Bit/96 kHz Multi I/O Recording Interface



TERRATEC PRODUCER PHASE 88 Rack

English Manual

Version 1.0, last revised: März 2004

CE Declaration

We:

TerraTec Electronic GmbH, Herrenpfad 38, D-41334 Nettetal, Germany hereby declare that the product:

TerraTec Producer PHASE 88 Rack,

to which this declaration refers is in compliance with the following standards or standardizing documents:

1. EN 55013
2. EN 55020

The following are the stipulated operating and environmental conditions for said compliance:

residential, business and commercial environments and small-company environments.

This declaration is based on:

Test report(s) of the EMC testing laboratory



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Important safety information

Please ensure that all analog devices are turned off before plugging them in. This will protect you from any possible—albeit weak—electrical shocks, as well as protecting your speakers and your hearing from sudden peaks. For digital devices, be sure to at least lower the volume on your playback equipment.

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Welcome!

We're pleased that you've chosen a TerraTec Producer audio interface for your musical endeavors and would like to congratulate you on your decision. With the PHASE 88 Rack audio system, you've purchased a sophisticated piece of state-of-the-art studio equipment. Thanks to its wealth of options and proven technology, it will serve you well—both in demanding studio environments and day-to-day home recording for years to come.

We hope that this brochure is helpful to you while using the product. It is designed to illustrate technical relationships based on practical examples from the studio environment. However, it is designed not only for beginners, but also for those more advanced in this complex matter: Ambitious professionals, too, will surely learn something new here and there.

We hope you find this manual both informative and entertaining to read, and hope you find lots of pleasure in the PHASE 88 RACK audio system.

Sincerely, Your TerraTec Producer Team

Here's an overview of what you can expect to find when you unpack the box:



Connection options and sound. The PHASE 88 Rack audio system is well-equipped with professional connection options—including eight balanced analog inputs and outputs, two microphone inputs, two separate MIDI interfaces, and one 2-channel digital input and output each, and a WordClock I/O—that will soon make it the hub of your home or project studio. Selected 24-bit/96 kHz converter modules, a signal-to-noise ratio of no less than 110dB(A) at the analog outputs and a sophisticated board design are the basis for crystal-clear recording and the playback of high-resolution 5.1/7.1 surround productions.

For everything you need to know about connections, see ➔ page 20.

Complex routing—very easy. As you know, a professional audio system is no sound card for wild-eyed gamers, but the heart of your day-to-day studio work with your PC. And despite the extensive routing options, the PHASE software always provides you with a clear overview and—depending on the complexity of your switching needs—remains transparent and intuitive.

For everything you need to know about the PHASE Control Panel, see ➔ page 28.

The drivers provided for the PHASE 88 RACK System, too, leave nothing to be desired. A highly developed software architecture guarantees problem-free use with all modern Windows and Apple operating systems.

The ASIO drivers—thoroughly proven throughout years of application and often used as a reference—allow the lowest possible latency between the software and audio interfaces.

For all about driver usage see ➔ page 24 (Windows) and 27 (MAC OS).

From opening the package to installation.

Before installing the PCI card into your computer and running cables to the PHASE 88 RACK audio system, take note of any special points pertaining to the configuration of your computer. Also refer to the manual of your computer and other studio peripheral devices for their settings.

If you follow the instructions, the installation should run without any problems. If you still have difficulties, please review carefully the relevant chapter in this manual.

Our service hotline team will be happy to help you if you have any other questions about the product. The phone numbers can be found in the Appendix of this documentation.

Scope of delivery.

Start by making sure that the contents of the package are complete.

The PHASE 88 System package should contain the following items:

- PHASE 88 Rack 19" module
- PHASE 88 PCI card
- 1 WordClock adapter cable
- External link cable (4m)
- EWS[®] connect sync cable
- PHASE 88 CD-ROM (driver and software)
- This manual
- Service request form
- Registration documents
- Besonic Premium Account

Please return the enclosed registration card to us at the earliest possible opportunity or register online at <http://www.terratec.net/register.htm>. This is important for support and hotline services.

The setup—Short and simple for busy professionals.

- Before installing the PCI card, please check the Sync-In and Sync-Out connections (EWS[®] Connect) on the PCI card. If you do not have any other TerraTec PCI systems with EWS[®] Connect connections in your computer, the following applies:
Sync IN (CN1)—set the jumper to 1-2; Sync Out (CN2)—this connector will remain unused. If you have other TerraTec PCI systems with EWS[®] Connect connectors in your computer, and want to synchronize them, please first read the chapter entitled “Cascading and internal synchronization.” (➔ page 39)
- The PHASE 88 Rack Audio Interface is a PCI card with bus-mastering support. Please choose a slot that is as far away from the graphics card(s) and SCSI/RAID controllers as possible—usually as close to the “bottom” as possible in most installations. Please keep the dangling S/PDIF connectors and heavy cables in mind which may get in the way of other connectors below them.
- You will need one (1) IRQ (additional IRQ tips in the appendix, see ➔ page 43). If you want to install multiple audio systems of the TerraTec range, you can do this in Windows without difficulty—all PCI cards operate in IRQ-sharing mode (please note the details on cascading here ➔ page 39).
- The driver installation in Windows (98SE to XP) follows the established defaults set by the operating system manufacturer. You can find the drivers on the accompanying CD-ROM or on the Internet at www.terratec.com/ in the SUPPORT area.

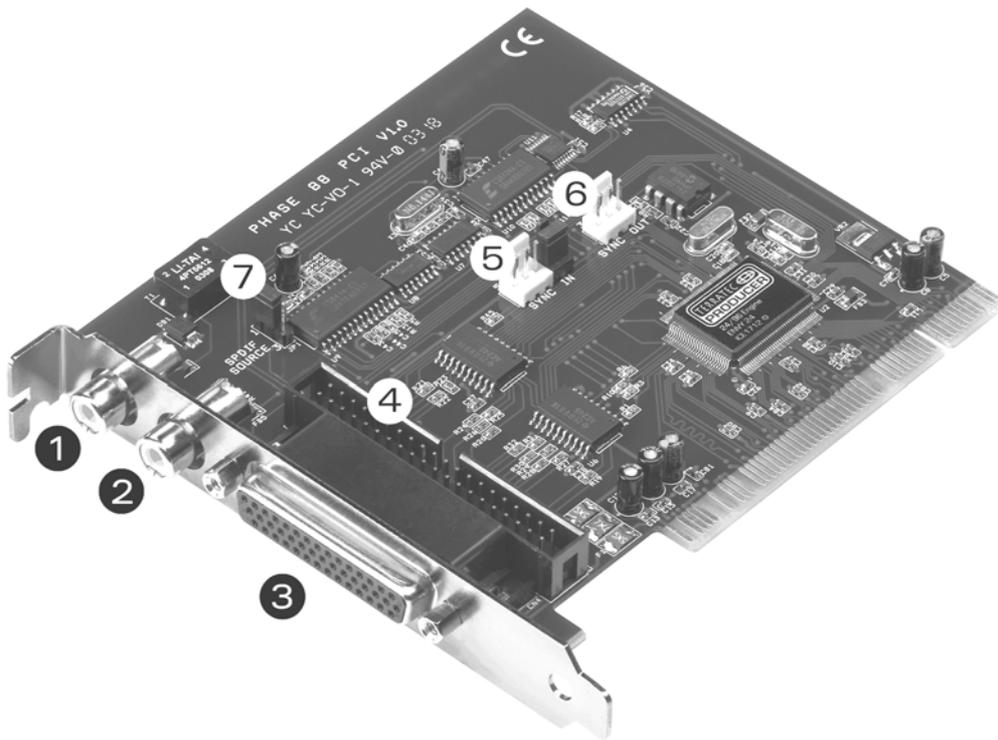
Notes for Windows users:

- The drivers have not been certified by Microsoft. You will receive a warning to this effect in Windows 2000 and XP, which you can safely ignore. **You can continue the installation without concern.**
- After installing the drivers, open the “Device Manager” and check for yellow exclamation marks.
- Like the drivers, the PHASE Control Panel must also be installed. Functionality of the card is not provided using the standard Windows Mixer. Open the installation via the CD-ROM autostarter (or don't forget to download the control panel when you are downloading the drivers in the Internet).
- The WDM audio drivers can be selected in the applications as usual. ASIO drivers are available in compatible programs; WDM kernel streaming is “not visible” (i.e. it is always available for applications and cannot be selected explicitly). The buffer sizes are configured in the PHASE Control Panel.

Notes for Macintosh users:

- The PHASE 88 system is shipped with driver support for MAC OS 10 (OS X). In the OS10 version, we recommend the Apple operating system update called “Jaguar” (current version 10.2.6). A version update, which can be obtained for an extra charge, contains some improvements specially geared towards audio applications.
- The audio and MIDI connection using OS 10(X) is built exclusively on the OS10 core audio/MIDI concept.
- Multiple cards cannot be cascaded under the MAC OS at present.

Structure of the PHASE 88 PCI card.



1. Digital output (S/PDIF and RAW data)
2. Digital input (S/PDIF and RAW data)
3. External connection for rack
4. Internal connection for the PHASE 88 5 1/4" module
5. Sync-IN connection for cascading (5-pin, the jumper must remain set on the master card!)
6. Sync-OUT connection for cascading (3-pin)
7. Jumper for selection of S/PDIF source (only in connection with a PHASE 88 rack or Mic 2/8 module)

The PHASE 88 rack housing



1. Microphone channel 7 (XLR)
2. Microphone channel 8 (XLR)
3. MIDI 1 IN
4. MIDI 1 OUT
5. Gain control, channel 1-6 (Line In)
6. Gain control, channel 7 + 8 (Line or Microphone)
7. Signal LED, channel 1-8
8. Clipping LED, channel 1-8
9. Button 48V phantom power, microphone inputs 7 and 8
10. Signal LED, phantom power
11. Power LED



1. MIDI 2 IN
2. MIDI 2 OUT
3. Analog OUT 1-8 (balanced, 1/4" jack)
4. Analog IN 1-8 (balanced, 1/4" jack)
5. WordClock connection
6. Provision for optical digital input and output of optional FireWire interface card
7. PCI card connection
8. Power (external 12V AC power adapter)

The PHASE 88 audio system includes a 19" rack module with 8 analog inputs and as many outputs—all with studio-standard 1/4" jack sockets. The included adapter cable connects the unit to the PCI card in the computer. With a length of 4 meters, the cable is long enough to cover greater distances.

An optional upgrade of the PHASE 88 rack module connection from PCI to FireWire (IEEE 1394) is planned for the near future. There's no need to worry, however: the unit can be upgraded easily when the time comes. The interface unit is a modular design and the board is simple to replace. We would nevertheless like to ask you to leave the upgrade to an expert, as opening the housing will otherwise void your warranty. And by the way—you won't lose the digital connections in the upgrade—they'll move from the PCI card to the rack unit. They will then be located right next to the FireWire connection.

One additional note: please use the included 12V AC adapter to power the rack module. We've grown used to bus-powered systems in the age of USB—just plug in the cable and the device's power needs are also taken care of—but that's not the case here. Well, then: don't be surprised if the Power LED doesn't come on immediately—just plug in the AC adapter. (Of course, most of our users won't need these instructions, but maybe they will save one or two from having to call our helpline unnecessarily.)

And finally, a note for the gearheads: Designing the PHASE 88 as a 19" rack module has the advantage of providing more room for technology than the older, internal version with the 5¼" breakout box. As a result, the already good channel separation could be improved further, making crosstalk between the individual channels even less of an issue than before.

Installation of the PHASE PCI card—step by step.

- Switch off your PC and all connected peripheral devices such as your printer and monitor. Leave the AC power cable connected for the time being, so that your computer is still grounded.
- Touch the metal chassis at the rear of the PC to ground and to discharge static. Now unplug the cord from the AC socket.
- Remove the housing cover from your computer or open it.
- If you wish to cascade multiple PHASE PCI cards internally, you should connect the sync cable now. It is a very fiddly operation if it is done after the PCI card has been inserted into place. For more useful tips see ➞ page 39.
- Select a free PCI expansion slot that if possible does not share an IRQ with any other slot (for more information see the appendix ➞ page 43), if necessary remove the screw that retains the slot cover and remove the cover. Should it be necessary to break a cover out of the case, do so with care to avoid injury.
- Carefully remove the PCI card from its packaging. To do so, place one hand on a metal part of the computer case while picking the card up by the edges. This will ensure that your body is completely discharged (no joke) of static electricity via your computer, so that no damage is done to the card.
Please do not touch the highly sensitive components on the card. Even the slightest electrostatic discharge could destroy them.
- Align the audio card so that the strip with the golden connector pins is located exactly over the PCI slot. Insert the card into the slot. You might have to press the card firmly into the slot to make good contact. Take care to ensure that the contacts are exactly in line (using force is not necessary!). If they are not, you could do damage to the audio card or your computer's motherboard.
- Fasten the card in place using the screw you removed earlier from the slot cover (if there was one).
- After switching the system on and booting it, you can now install the drivers (see ➞ page 15 for Windows, ➞ page 19 for MAC OS X).

Driver installation in Windows.

The PHASE 88 Rack system is shipped with drivers for the Windows 98SE, Windows ME, Windows 2000, Windows XP and MAC OS10 x operating systems. Windows NT 4 as well as MAC OS9.x are not supported. You should therefore determine which operating system you are using before installing the card. For information on your operating system and its version number, please check the "System" dialog in the Windows Control Panel.

In the following driver installation descriptions, <CD> stands for the drive letter of the CD-ROM drive containing the PHASE driver CD.

Driver installation under Windows 98 SE.

1. Once you have installed the PHASE 88 PCI card in your computer, connect the 19" rack module. Now boot the computer.
2. During the bootup process, the Windows hardware wizard will identify the new hardware as a "PCI Multimedia Audio Device". Confirm by clicking "Next".
3. The hardware wizard will ask you how you would like to continue. Select the "Search for the best driver for my device (Recommended)" item and confirm with "Next".
4. Check the "Specify a location" box and enter the path to the driver on the CD. <CD>:\PHASE 88\Driver\PC\Vx.xx\ or the root folder of the CD (<CD>:\). Alternatively, you can also select the path to the best driver of your PHASE 88 PCI system using the mouse by clicking "Browse...". Confirm by clicking "Next".
5. In the last window, the hardware wizard will report that the driver software has been installed successfully. Close the wizard by clicking "Finish". If contrary to all expectations a request should appear for you to perform some action and you are not sure about it, then pressing the Enter key is generally a safe action. If Windows requests a second driver file, please refer to the aforementioned directory on the PHASE CD-ROM. It is also possible (e.g. if this is the first sound card installation in your system) that some additional Windows extensions have to be installed. Please have your Windows CD ready for this purpose.

After successful driver installation, the PHASE 88 control panel can be installed easily using the autorun option (<CD>:\autorun.exe).

Follow the instructions on the screen to install the various bundled software programs. The control panel application is also easy to remove from your system. To do so, open the "Add/Remove Programs" dialog from the Control Panel. Search for the program to be deleted, select it and click "Change/Remove".

After a successful driver installation, you should verify that your Windows 98SE system is functioning properly. The Device Manager presents an overview of hardware components installed and recognized on your computer. The Device Manager can be found in the Control Panel under "System".

Driver installation under Windows Me.

1. Boot your computer after installing the PHASE 88 PCI card.
2. During the boot, the Windows hardware wizard will identify the new hardware as a "PCI Multimedia Audio Device". Select here "Specify the location of the driver (Advanced)" and confirm with "Next".
3. Mark the "Specify a location" checkbox and enter the path `<CD>:\PHASE 88\Driver\PC\Vx.xx\` or the root folder of the CD (`<CD>:\`). Confirm by clicking "Next". Alternatively, you can change to the respective directory by clicking on "Browse...".
4. The hardware wizard will now search for the audio system PHASE 88 driver and will display the location of the driver. Confirm by clicking "Next".
5. In the final window, the hardware wizard will report that the driver software has been installed successfully. Close the wizard by clicking "Finish".

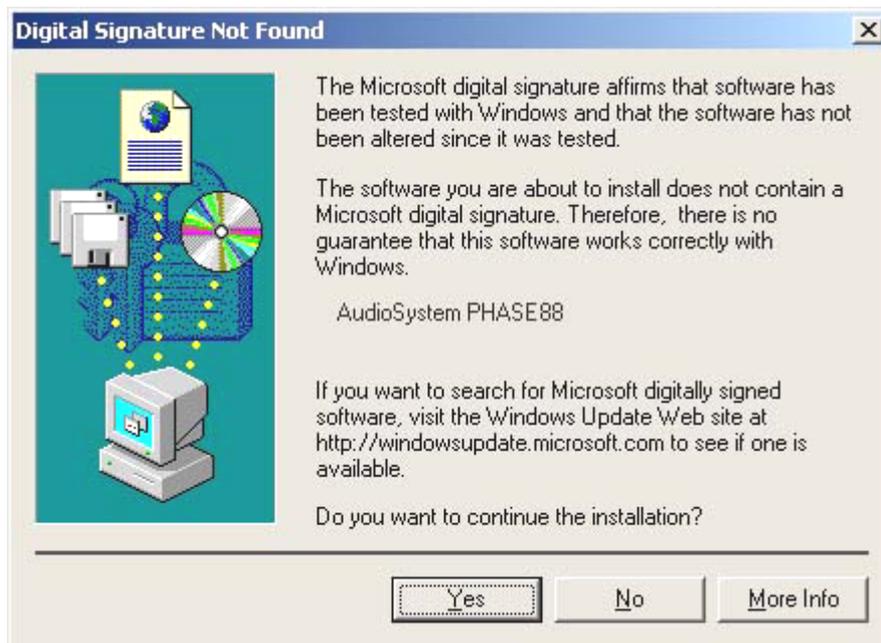
After successful driver installation, the PHASE 88 control panel can be installed easily using the autorun option (`<CD>:\autorun.exe`).

Follow the instructions on the screen to install the various bundled software programs. The control panel application is also easy to remove from your system. To do so, open the "Add/Remove Programs" dialog from the Control Panel. Search for the program to be deleted, select it and click "Change/Remove".

After a successful driver installation, you should verify the correct condition of your Windows ME system. The Device Manager presents an overview of installed and recognized hardware components of your computer. The Device Manager can be found on the Control Panel under "System" > "Hardware". Then click the "Device Manager" button.

Installation under Windows 2000.

1. Boot your computer after installing the PHASE 88 PCI card.
2. During the boot, the Windows hardware wizard will identify the new hardware as a "Multimedia Audio Controller". Confirm by clicking "Next".
3. Mark the "Search for a suitable driver for my device (recommended)" checkbox and insert the PHASE CD if you have not done so already. Subsequently confirm with "Next".
4. The hardware wizard will now inform you that it will search for drivers for a "Multimedia Audio Controller". Activate the checkbox "CD-ROM drives" and confirm with "Next".
5. Next, the hardware wizard will indicate that a suitable driver was found on the CD-ROM for the "Multimedia Audio Controller" (<CD>:\PHASE 88\Driver\PC\Vx.xx\ or directly in the root folder of the CD <CD>:\) Start the installation by clicking "Next".
6. The following dialog box will now appear as the installation is continued:



This is no cause for alarm. Click "Yes" to continue. The installation will now be executed. If contrary to all expectations an additional request should appear for you to perform some action and you are not sure about it, then pressing the Enter key is generally a safe action.

If Windows requests a second driver file, please refer to the aforementioned directory on the PHASE CD-ROM. It is also possible (e.g. if this is the first sound card installation in your system) that some additional Windows extensions have to be installed. Please have your Windows CD ready for this purpose.

After successful driver installation, the PHASE 88 control panel can be installed easily using the autorun option (<CD>:\autorun.exe).

Follow the instructions on the screen to install the various bundled software programs. The control panel application is also easy to remove from your system. To do so, open the “Add/Remove Programs” dialog from the Control Panel. Search for the program to be deleted, select it and click “Change/Remove”.

After a successful driver installation, you should verify the correct condition of your Windows 2000 system. The Device Manager presents an overview of installed and recognized hardware components of your computer. The Device Manager can be found on the Control Panel under “System” > “Hardware”. Then click the “Device Manager” button.

Installation under Windows XP.

1. Boot your computer after installing the PHASE 88 PCI card.
2. During the boot, the Windows hardware wizard will identify the new hardware as a “Multimedia Audio Controller”. If you have not done so already, insert the PHASE CD-ROM now. Finally enable the checkbox “Install software from a specific source [for advanced users]” and confirm with “Next”.
3. In the next window enable the checkbox “Search removable media (diskette, CD, ...)” and confirm with “Next”.
4. The following dialog box will now appear as the installation is continued:



This is no cause for alarm. Click “Yes” to continue. The installation will now be executed.

5. In the final window, the hardware wizard will report that the driver software has been installed successfully. Close the wizard by clicking “Finish”.

If contrary to all expectations an additional request should appear for you to perform some action and you are not sure about it, then pressing the Enter key is generally a safe action.

If Windows requests a second driver file, please refer to the aforementioned directory on the PHASE CD-ROM. It is also possible (e.g. if this is the first sound card installation in your system) that some additional Windows extensions have to be installed. Please have your Windows CD ready for this purpose.

After successful driver installation, the PHASE 88 control panel can be installed easily using the autorun option (<CD>:\autorun.exe).

Follow the instructions on the screen to install the various bundled software programs. The control panel application is also easy to remove from your system. To do so, open the “Add/Remove Programs” dialog from the Control Panel. Search for the program to be deleted, select it and click “Change/Remove”.

After a successful driver installation, you should verify the correct condition of your Windows XP system. The Device Manager presents an overview of installed and recognized hardware components of your computer. The Device Manager can be found on the Control Panel under “System” > “Hardware”. Then click the “Device Manager” button.

Driver installation for Macintosh OS X.

In the OS10 version, we recommend the Apple operating system update called “Jaguar” (current version 10.2.6). A version update, which can be obtained for an extra charge, contains some improvements specially geared towards audio applications. The system requirements are OS10.1 or higher. Furthermore, in order to install the drivers, you must have administrator rights on the system.

To install the PHASE 88 MAC OS X—driver and the Control Panel application, select the program PHASE88_x.x.xxx.pkg from the directory <CD>:\PHASE 88\Driver\MAC\ of the PHASE 88 product CD. For identification, enter your name and your OS X password. During installation, you will be asked for the target drive; select the desired target drive. Follow the instructions of the installer and complete the installation by rebooting your system.

After restarting the system, you can select the PHASE 88 Control Panel from the directory Macintosh HD -> Programs.

The connections of the PHASE 88 Rack audio system.

The PHASE 88 Rack audio interface offers you numerous connections for connecting professional studio peripherals. Following is a detailed overview of its technical and electrical characteristics:

Analog outputs.

The analog outputs of the PHASE 88 Rack operate with music-compatible line levels. Here, you can connect a mixing card, active speakers, or amplifiers.

The PHASE 88 Rack system has eight high-quality balanced analog outputs, which can be independently addressed. Sockets are available on the rear of the 19" housing for 1/4" jack connectors. They are always shown in pairs on the driver side and in the PHASE Control Panel (i.e. 1/2, 3/4, 5/6, 7/8). Of course, you can also control the channels separately (in mono). However, you will usually control the volumes from within the audio software application you use.

Practical tip: Make full use of the 24-bit support of up-to-date software applications and connected digital peripherals—even if you are planning to “just” release your production on CD. The additional sound quality is audibly worthwhile, both in the sum of the signals and, above all, during digital postproduction.

Analog inputs.

The sensitivity of the Line inputs of the PHASE 88 Rack audio system can be adjusted with the gain controls on the front panel to ensure the optimal utilization of the 24-bit converters.

The PHASE 88 Rack system has eight high-quality balanced analog inputs, which can be independently used. The inputs feature sockets for 1/4" jacks, with individual gain controls (20 dB range) on the front panel of the rack module. Unlike software solutions, this electronic form of volume control takes effect before the converter modules, which is also beneficial for the signal-to-noise ratio. The unit is also equipped with individual peak LEDs for each channel to help keep unintentional peaks and distortion in check. Status LEDs indicate whether a signal is available at the individual channels.

Two XLR connectors for microphones are located on the front panel. The input levels can be adjusted using the gain controls for channels 7 and 8. High-quality condenser microphones also require 48V phantom power that can be activated for both microphone inputs using the button in the control panel for channel 8. As a result it is not possible to use one microphone with phantom power and one without. The LED next to the button indicates whether power is being applied.

Practical tip: While recording, try to achieve as high a recording level as possible to get the greatest benefit from the wide dynamic range of the 24-bit converter. As a rule of thumb for good recordings, always take the following into account: a clean “take” is much more valuable than the best plug-in for later sound correction.

Intermezzo: a cable and signal primer

You may now ask yourself: why bother with analog Line-IN and microphone inputs? Why not simply plug the mike into one of the eight jack sockets? And—and what the heck are “balanced inputs”?

Cables obviously have the simple task of getting a signal from point A to point B. And they have to do it with a minimum of interference. However, the quality and nature of a signal can vary widely depending on its source. In the case of microphones, for example, the currents and output voltages are very low, but the output impedance is quite high. As a result, microphone signals are very vulnerable to interference and require special microphone preamps. They are not only susceptible to interference from the magnetic fields of other cables, but also from fluorescent lights, fans and other electrical equipment.

In contrast, line signals have already been amplified when they are sent on their way and are therefore no longer quite so vulnerable. While more current is flowing here (and the output impedance is quite a bit lower) and the output voltage is somewhat higher, it's still not enough to power a speaker directly—line signals also still need to be amplified. Examples of line signals are the outputs of keyboards, mixers or effects devices. (But not a Speaker-Out. Please never apply one to a Line-In—your hardware will appreciate it.)

And that finally brings us to the topic of “balanced” and “unbalanced” lines. Simply put, unbalanced lines consist of two conductors, a center conductor and a shield, while balanced lines have two center conductors (not to be confused with stereo lines). As both conductors have the same voltage but opposite polarity, the effects of any interference on the line are effectively cancelled out. Professional microphones will therefore always use balanced lines (or they should, at any rate). Unbalanced connections may be adequate for line signals—but a balanced connection will always be better and more reliable. Like those of the PHASE 88 Rack audio system. By the way: the old saying about a chain only being as strong as its weakest link also applies in the studio—especially there, in fact. In practice, that means that you shouldn't try to economize on quality cables with excellent shielding. Most noise is the result of defective or cheap cables—not sloppily-designed hardware. It's always worth investing a bit more for quality.

Digital interface (S/PDIF, RAW, AC3).

Devices that can process the S/PDIF protocol or Dolby AC3 signals can be connected to the coaxial digital interface (cinch plugs). This includes, for example, DAT recorders and many hi-fi components, or even other computers that you want to connect to the audio network (VST System Link).

Use the digital interface of your PHASE 88 PCI card to transfer music digitally from your computer to other devices, or to record audio data with your computer. There are two separate coaxial jacks (RCA / jack) for recording and playback.

The cables for digital connections are always connected “crosswise”, meaning OUT to IN and vice-versa. Pulses are transmitted together with the audio data when the S/PDIF protocol is used. This is known as the sample rate. The interface of the PHASE 88 Rack system can send and receive up to 96 kHz.

The correct driver for recording digital sources is called “PHASE 88 Digital”.

Should you decide at a later date to upgrade from the PCI connection to the optional FireWire (IEEE1394) board, the digital interface will be moved from the PCI card to the rack module.

You can find detailed information on the digital interface settings in the PHASE Control Panel beginning on ➤ page 30

Practical tip: For an absolutely clean and jitter-free signal path (when mastering, for example), use special shielded cables to transfer digital data via the coaxial interface. For more tips see ➤ page 47.

***Advertisement ;-)* TerraTec's Vice Versa is a compact digital converter, which allows audio devices to be connected with optical TOSLink connections to electrical cinch connections—and vice-versa. This clever switching technique allows you to select whether to use Vice Versa as a bi-directional converter or as a signal repeater. For more information, go to <http://www.terratec.com/>.**

MIDI interface.

The Phase 88 Rack audio system has two separate MIDI interfaces—one each on the front and back panels of the 19" rack module. These are designed for connections to suitable peripherals such as MIDI keyboards, DAW controllers and many other devices.

The cables for MIDI connections are always connected “crosswise”, meaning OUT to IN and vice-versa. MIDI sequencer software usually offers you to loop MIDI data through, using the Through function.

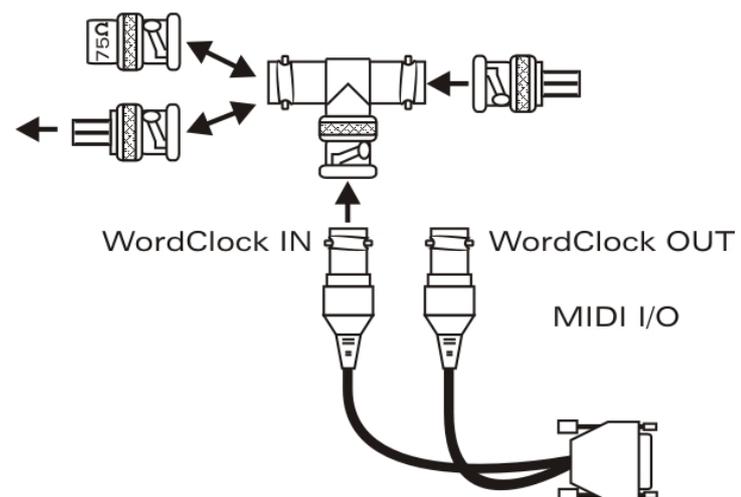
Practical tip: Even if your input keyboard (master keyboard) has a USB connection available, you should use the MIDI input (IN) of the PHASE 88 whenever possible: the “direct connection” to the PCI data bus of the computer, and thus to the MIDI software, allows a substantially faster and more stable timing than most USB-MIDI interfaces. Of course, the same is true for the output when it is needed.

WordClock I/O

A Sub-D socket is located on the back for the included WordClock cable. The WordClock is used to synchronize the PHASE 88 Rack audio system with other devices that use this rather common studio format, such as digital recorders, digital mixers, other PCI cards and much more. When synchronizing the PHASE 88 rack system externally as a slave via the WordClock interface, please don't forget to use a suitable 75 ohm BNC terminator (not included). Terminating the WordClock input is not necessary when using the PHASE 88 rack system as the master.

Termination if device is the last one in the chain

WordClock Out for additional digital slave devices



The drivers (Windows operating system).

The PHASE 88 Rack audio interface features a range of drivers for a variety of applications. The drivers support all bit rates between 8 and 32 bits with all common sample rates between 8 and 96 kHz. As a rule, the sample rates are not “interpolated”. In other words, the system always automatically sets itself to the sample rate with which an application is recording or playing back. This prevents quality losses due to internal sample rate conversions. There are exceptions, however, which we will be covering below.

But now to the individual drivers.

The Wave driver.

In most Windows programs, you will encounter drivers with the designation “PHASE 88 Wave x/x” for recording and playback. In order to address the outputs of the Audio Interface, you will also find a numbering that corresponds to five output pairs: 1/2, 3/4, 5/6 and 7/8, as well as Digital Left/Right.

If you have multiple cascading audio interfaces, the operating system, as a rule, numbers the driver names from 1 to 4. “As a rule” means, in plain English, that there can be exceptions under Windows over which we (unfortunately) have no influence.

Depending on the application software, the driver names are displayed with supplements that refer to the audio architecture of the operating system: MME, WDM or DirectSound (see below for more information).

The ASIO driver.

Programs that make use of Steinberg's ASIO interface indicate in the corresponding dialogs the ASIO drivers of the PHASE 88 System. With ASIO, programs achieve extremely short delays (latency) during audio recording and playback. Therefore, a latency of significantly less than 10 ms should be targeted. For fast, well organized systems, even latencies of less than 1 ms are possible at sampling rates of 96kHz!

The ASIO driver is listed in compatible programs under “ASIO for PHASE 88”. The inputs and outputs (usually “buses”) available in the programs are called “PHASE (n) Out”, where n is used to distinguish between multiple PHASE interfaces (1 to 4, see ↻ page 36). In many cases, only the left channel of the output pair (1/2, 3/4, 5/6, 7/8 and Digital Left/Right) is stated, it applies for both channels however.

The GSIF driver.

The GSIF driver of the audio interfaces is also visible only in certain programs. The GigaStudio sampler application and other Tascam / Nemesys products can also access the hardware in a very fast and direct manner. The outputs available in each program are called here "PHASE 88 GSIF (n)" and lead directly to the outputs of the PHASE 88 audio system.

The MIDI driver.

For the recording and playback of MIDI data via the MIDI IN and OUT jacks, a separate driver is available.

The driver designated as "PHASE 88 MIDI 1" (or MIDI 2) in this system, and it can be selected in any situation in which its use would be appropriate.

Practical tip: If MIDI files, which can be played back using Windows' media players, are also to be transferred to externally connected devices, open the "Sounds and Multimedia Properties" dialog window from the Windows Control Panel and set the "MIDI Music Playback" device to the driver mentioned above.

In detail—special properties of the drivers.

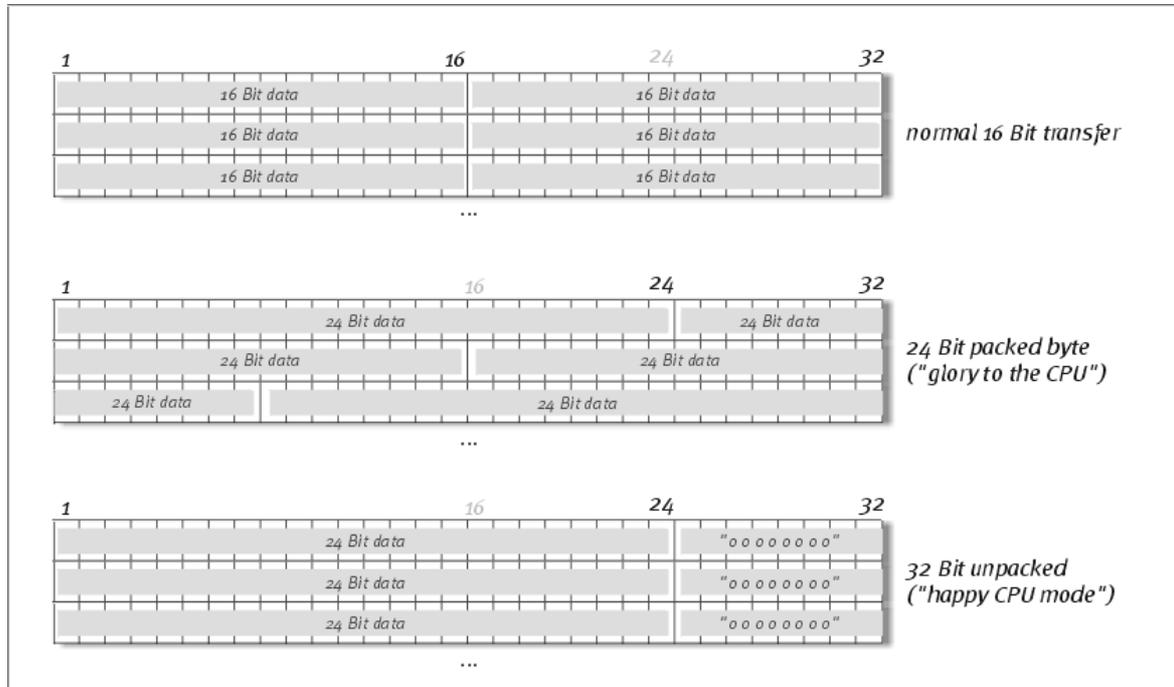
The following contains in-depth information for those with the need to know. Less experienced users won't encounter any problems if they skip over this section.

32-bit data transfer.

The drivers support a special data transfer format known as “32-bit unpacked”. Audio data streams are transferred to the computer's main memory via the PCI bus. The PCI bus features 32 “lines” (32-bit). A PC generally takes care to ensure that its data lines are well-utilized. For this reason, 8-bit audio data is always sent on its way in groups of four packets ($4 \times 8 = 32$), and 16-bit data ($2 \times 16 = 32$) in groups of two (diagram above).

The situation is a bit more complicated from the processing standpoint with 24-bit audio data: suddenly there's “only” 24 sweet-sounding bits available, i.e. 8 bits are “missing”. The “24-bit packed” process solves this problem in the following manner: the computer CPU (your Pentium, for example) divides the 24-bit data into multiples of 32 (middle of diagram). That costs computing power and isn't really necessary.

The “32-bit unpacked” process fills the remaining bits with zeroes and the driver sends suitable 32-bit packets on their merry way. Most commonly-used applications currently support this process, which is particularly easy on the computer's resources (bottom of diagram).



DirectSound & WDM.

It goes without saying that the drivers of the PHASE 88 system also support Microsoft's DirectSound or DirectSound 3D interface. What's more, the software complies strictly with Microsoft's WDM specification. WDM (Windows Driver Model) is a recent driver concept from that popular Redmond-based software manufacturer which involves a number of innovations in the audio sector. For example, the drivers are able to play back audio data streams from multiple applications in parallel (multi-client, a "luxury" that faithful TerraTec customers have enjoyed since 1997).

WDM sample rate (SR) interpolation.

The multi-client capability of the WDM architecture also permits the simultaneous playback of multiple audio data streams with differing sample rates. The sampler frequency used for all streams is based on the file called up first. All further data streams—those called up during the run time of the first file—are interpolated as required and their pitch is not affected.

Because SR conversion and interpolation always involves a certain loss of quality, if you are using applications where the highest possible audio quality is important, make sure that multiple programs are not using different sampling rates simultaneously. For example, it's best to only have the playback software running when transferring a piece of music at 44.1 kHz to a DAT recorder.

WDM kernel streaming.

WDM kernel streaming also represents a new technology for Microsoft. Like already established models such as Steinberg's ASIO interface, kernel streaming permits extremely fast access to the audio hardware. The deployed software (such as audio/MIDI sequencers or software synthesizers) must support the WDM function directly, however. One of these programs, for example, is the "Sonar" recording software produced by the Cakewalk company.

The MAC OS X drivers.

The driver version available for the current, first shipment is based completely on the MAC OS X CoreAudio or CoreMDI concept. With the help of the CoreAudio support, the PHASE 88 system can be used with extremely low latencies within an Audio/MIDI sequencer (e.g. Emagic Logic or Cubase SX). A special ASIO driver is not mandatory. As soon as the software products announced by the Steinberg company allow direct ASIO connection to the hardware, the development of corresponding PHASE 88 PCI card support is planned.

Under System Settings -> Sound, the PHASE 88 system can be set up as the default audio device in OS X.

The Control Panel.

The PHASE Control Panel is—beside the drivers—by far the most important piece of software in the package. Here, depending on the requirements of each situation, you can have total control of the audio interface, reduce volumes (take this literally!), control one of the two input preamplifiers, as well as load and save settings.

Note: the functions and the position of the control elements are as identical as possible under Windows and MAC OS. The following illustrations correspond to the Windows version of the Control Panel.

How does the Control Panel work?

The Phase Control Panel and the routing (signal flow within the card) is very easy to understand. You still want to know what it is all about? Very well: the following are the individual function blocks, from left to right:

Analog Inputs

Please don't be surprised if you can't select this tab in the Control Panel—it's correct that the tab is present, but grayed out and disabled. The explanation is simple (no, you have not forgotten to install the driver, don't worry!): In principle, the Control Panel is identical to that of the PHASE 88. In the rack version, the software input sensitivity controls for the analog inputs have been replaced by hardware controls on the rack module. This—as mentioned previously—not only has ergonomic, but also technical advantages, as the sensitivity can now be controlled before the converter modules to optimize the signal-to-noise ratio. An additional software solution would still be easy to realize, but there wouldn't be any point in it.

Digital Mixer.

The PHASE 88 control panel includes an internal 36-bit digital mixer, which you can use or bypass if you don't require it.



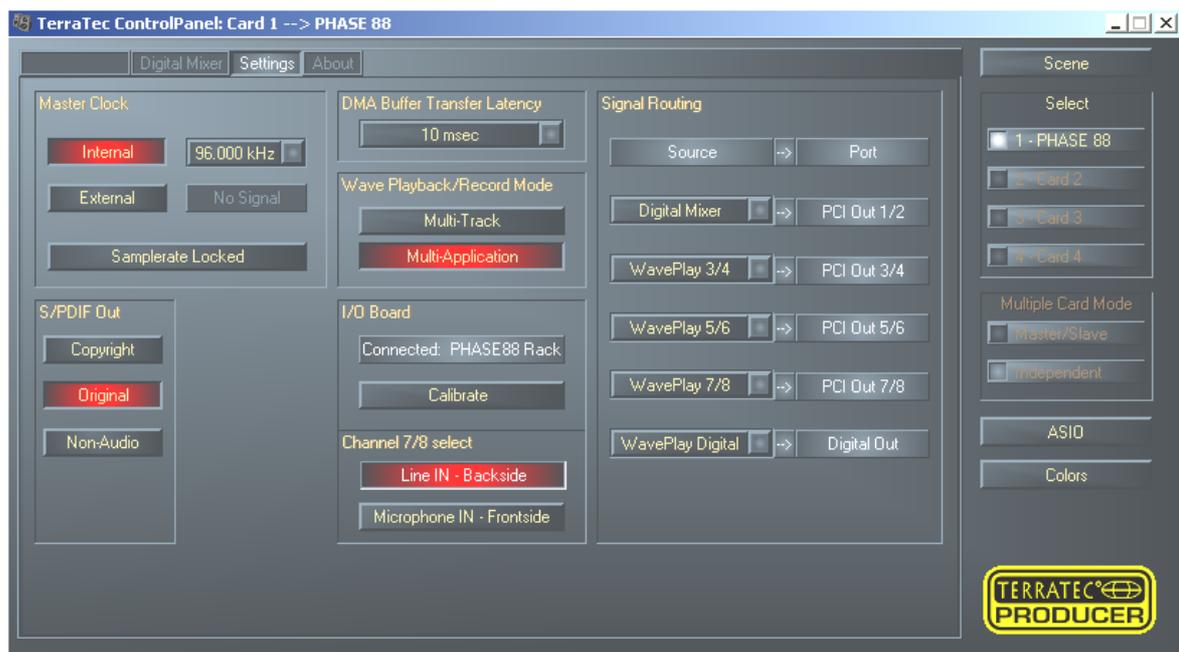
The Digital Mixer page of the Control Panel

The Digital Mixer mixes all signals played back by the drivers and it also combines the signals pending at the physical inputs. Switch between the 'Wave' and 'Input' pages to see the level and to control the volumes.

The total of all mixed signals can be regulated with "Master Volume", and then the "Digital Mixer" entry in the routing dialog (settings page) can be used to send the signals to the analog outputs 1+2 and to Digital Out.

If you want to use the PHASE 88 Rack audio system and an "in-out card" only for your audio/MIDI sequencer, you don't really need the Digital Mixer. As described in several places above, in this case the software that you use controls the volume and panorama settings. In practice it goes directly from the software to the outputs.

Settings.



The Settings page of the Control Panel

Master Clock.

Here we're dealing with the sample rate used by the PHASE 88 Rack System. This is a very important point, as the card can be clocked by an external signal (External, e.g. from a DAT recorder) or it can set a sampler rate itself and provide this signal to other devices.

You can choose from all commonly used sampler rates from 8 to 96 kHz—the actual bit rate is not important at this point. In the case of external synchronization (i.e. via a signal applied to the digital interfaces or the internal connection to cascade multiple cards), the external sampler rate will be displayed. If no signal is available or the connection has been interrupted, the message “No Signal” will be returned.

The audio controller of the PCI card does *not* feature a sample rate converter. This module—which is common on consumer sound cards—normally lets you play back signals with a variety of sampler rates by “interpolating”, as needed, the sample rates in real time to a specific frequency. When using the WDM or CoreAudio drivers you can also play back audio from multiple programs simultaneously. In this case also all “pending” sample rates are converted by the operating system (interpolated).

Caution: The software-based interpolation through the operating system involves an audible loss of quality. For professionally oriented recording and playback of audio material make sure that the sampling rate of the card is matched to the desired recording and playback sampling rate. Otherwise you can also use the ASIO driver—in this case the sampling rate is fixed in the application used.

The “Sampler Rate Locked” switch also permits the sampler frequency to be set to a fixed (or externally specified) value.

If playback or recording is started with a different sampling rate, the Windows or MAC OSX operating system runs a software-based sample rate conversion to the hardware frequency. Applications with ASIO support are an exception: they report sampling rate conflicts or automatically synchronize themselves to the hardware sampling rate.

The I/O card.

An extremely simple range of the PHASE Control Panel. If the Rack module is disconnected from the PCI card (how can this occur if it is screwed in place?), the converter should be recalibrated. This procedure won't take long and doesn't hurt a bit. However, always make sure that the module is not removed or docked during the operation. This could damage it.

Channel 7/8 select.

The input channels 7 and 8 are suitable for both line and microphone signals. Line signals must be applied to the 1/4" jack inputs on the back of the 19" rack module, while the XLR sockets on the front panel are reserved for microphone signals. Use the “Line In – Backside” and “Microphone In – Frontside” switches to set the active inputs. Please note that the inputs can only be selected as a pair. It is not possible to use the pair in mixed mode, i.e. Line In on channel 6 and Microphone In on channel 7 at the same time. If you would like to use condenser microphones with 48 V phantom power, you can apply the power directly to channels 7 and 8 (as a pair) from the 19" rack module.

Wave Playback/Record mode (Windows only).

The Wave Playback/Record mode determines whether you want to work with one program only (e.g. audio sequencer) or with multiple programs simultaneously. As previously seen above (“The master clock”), multiple programs with different sampling rates cannot be used without interpolation (under Windows via the WDM driver). This is not a problem with the same recording and/or playback frequencies: just switch to the “Multi-Application” mode. In the “Multi-Track” mode all WavePlay drivers (or WaveRecord) are only available for an open program. This will generally be your preferred hard disk recording application. The special mode is exactly appropriate for this rule, because in Multi-Track mode all drivers (WavePlay 1/2, 3/4, 5/6 etc.) must not only be available simultaneously for the application but also start sample synchronously (absolutely simultaneously). An extremely important property, which is essential in professional recording use.

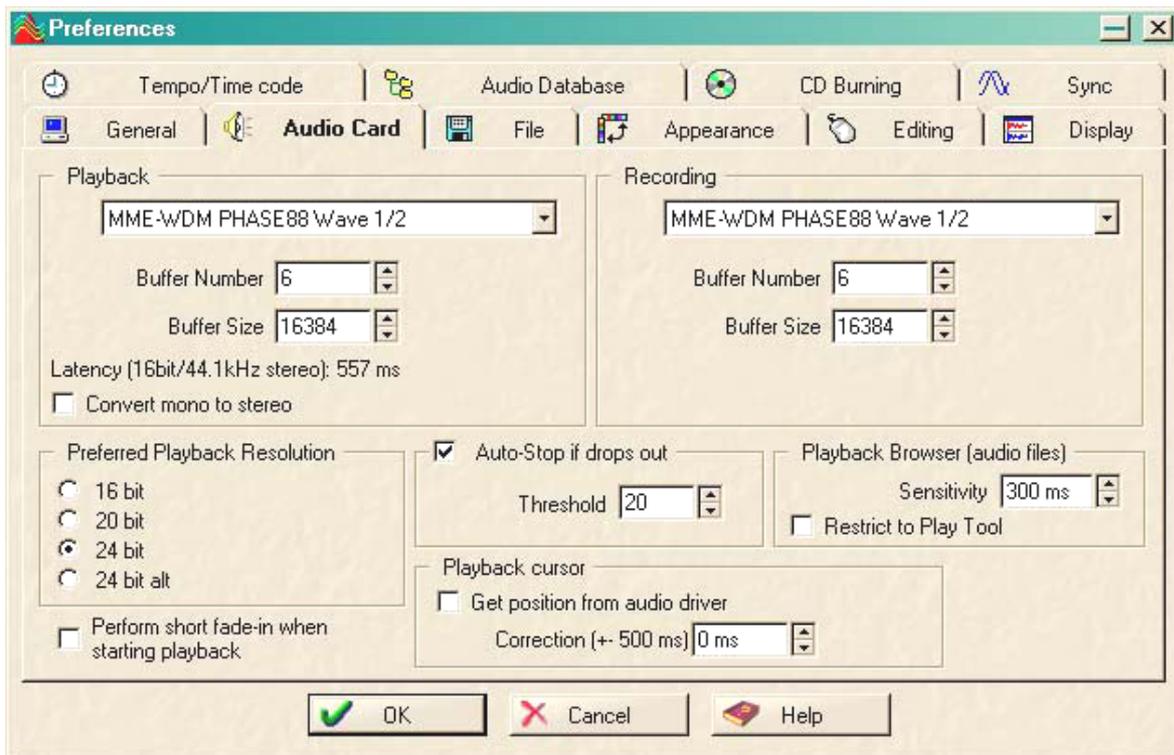
Digital Out.

Here you can specify the inclusion of protective information in a signal that you are sending across a digital interface. It is possible to add copy-protection information (original) to your recording when transferring it to another device. This can be useful when recording a composition to DAT or a MiniDisk as a demo to prevent (digital) copies from being made.

- **Copyright** adds a copy-protection ID to the signal or filters it out when deactivating copy protection. This function sets the so-called “copy protection bit” which ensures that no digital copies can be made of the signal.
- **Original** activates the so-called “generation bit”, permitting exactly one digital copy to be made. Disabling this function sets the bit to 0—you can then copy to your heart's content.
- **Non-Audio** allows transfer of additional control information and thus enables playback in RAW format (e.g. for AC3 or DTS).

The DMA Buffer Transfer Latency (Windows only).

A long phrase with high information value—at least if you want to or must use software without ASIO support. Here you determine how fast an application (e.g. a software synthesizer) can access the Windows MME and WDM drivers. You might think faster is better, but there's a catch: The setting is system-dependent and—if the system is too slow—an excessively low value will result in audible dropouts during recording and playback. If you detect dropouts when playing back audio tracks with your hard disk recording program, increase the DMA buffer transfer latency. The “tuning” of your application is also important in this regard, however. Many programs offer setting options for the audio buffer.

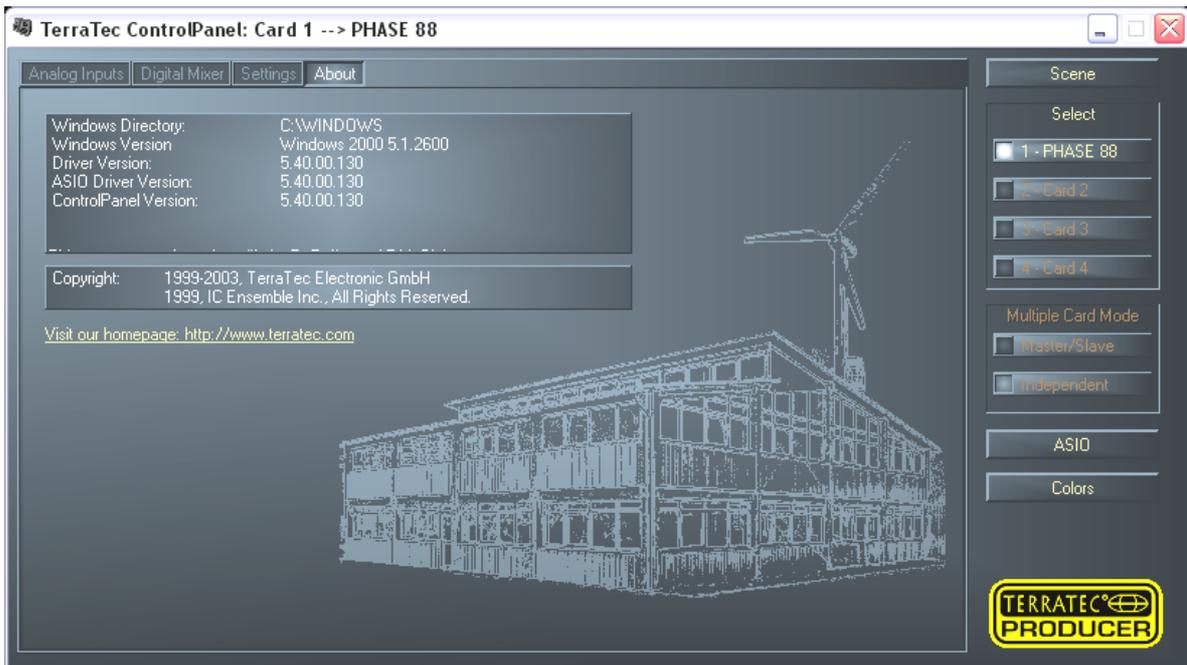


Setting the buffer sizes in WaveLab 4.

A tip for balancing: If speed is important—i.e. a low delay during playback—try to keep the number of buffers and their size as low as possible. Lower the DMA buffer transfer latency step-by-step in the PHASE Control Panel. The drivers are cleanly programmed and have been designed for speed. This should yield reasonable values that will be a pleasure to work with on appropriately configured systems.

Note: the settings for the DMA buffer transfer latency do not affect the performance of the ASIO or GSIF drivers (see ↻ page 24).

The About page.



The About page of the PHASE 88 Rack Control Panel

The About page contains some important system information, which could be helpful if you need to contact the help line or you need driver updates—as well as a picture of our company headquarters in Nettetal on the lower Rhine that looks like a potato stamp (unfortunately only Windows ...). Hover over the info area with the mouse cursor for additional information.

The PHASE Control Panel in the Windows taskbar.

The PHASE Control Panel icon in the Windows taskbar (bottom right near the clock) appears when the PHASE Control Panel has been loaded. Right-clicking the icon offers direct access to a number of functions that are also available from the Panel itself—please see the sections above for further information.

- **Show / Hide.** Displays the panel or hides it.
- **Select Card.** In cascaded audio systems, select the card you want to control here. You can also do this using the keyboard. Press the keys 1 to 4 on the numerical keypad.
- **Select Page.** Directly selects a page of the panel. The dialogs for scene management, colors and ASIO/GSIF settings can also be selected via the keyboard.
- **Advanced – Direct Monitoring.** This function can be used to enable or disable the Direct Monitoring support of the PHASE 88 system. ASIO 2.0 enables direct “monitoring” over suitable audio hardware like the PHASE 88 system. If this function is enabled in the audio application (e.g. Emagic Logic: disable the “Softmonitoring” option, in Cubase VST: enable the “DirectMonitoring” option in the control panel), the corresponding channel in the Digital Mixer of the PHASE 88 Control Panel “demuted” as soon as recording is enabled. In addition, volume and panorama settings are continuously sent from the sequencer mixer to the digital mixer of the PHASE 88 audio system. The playback path (not the recording path) now no longer runs over the sequencer. Instead the relevant input signals are sent directly through the digital mixer to the output 1/2 and/or Digital Out (if the routing of the PHASE 88 system has been appropriately set in the setting window of the Control Panel). Because the signals are sent directly to the hardware of the PHASE 88 without a detour, absolutely latency-free monitoring is possible.
- **Exit.** ... or Alt+F4. Done. Finished. Basta. Outtahere. That's all, folks.

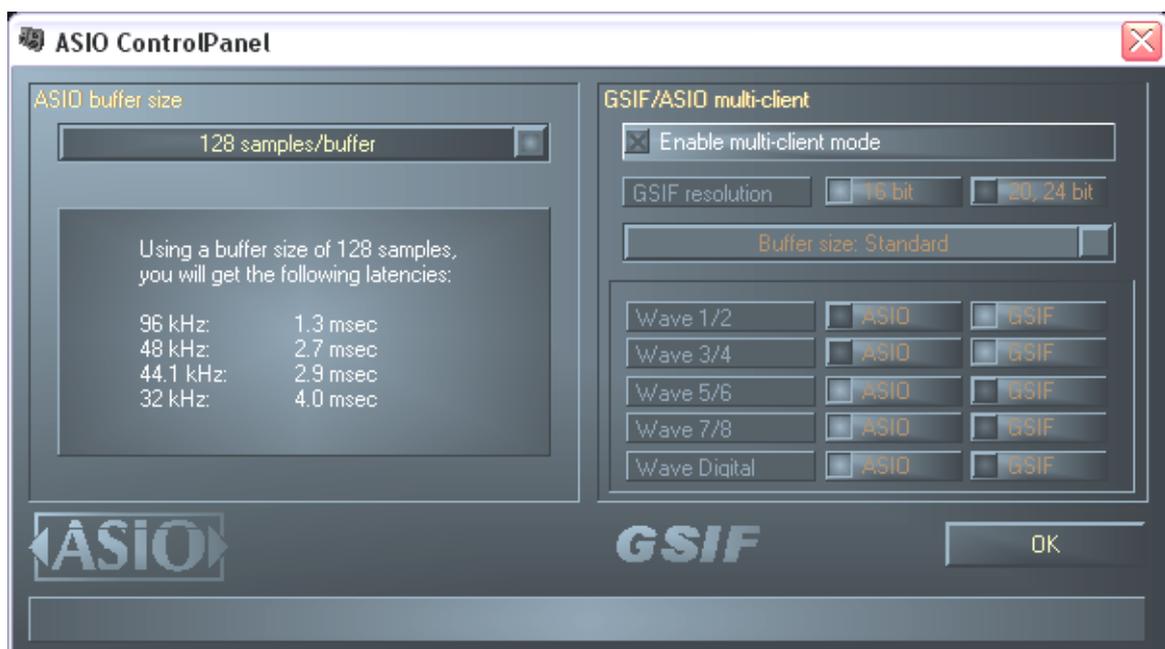
Managing scenes and cascaded cards (Windows only).

In modern digital mixers it's known as "total recall"—PC users would call it "load" and "save". Under the "Scene" button on the right edge of the PHASE Control Panel you have the option of saving all card settings (Save), loading (Load) or deleting previously saved scenes (Delete). Use "Cancel" to exit the dialog without saving.

The card selector (Select) is also always accessible at the right-hand side. Here you switch the view for operation with multiple cards of the EWS/PHASE family if they are installed. Please note that the scene memory function always saves **all** settings for **all** of the cards.

ASIO Control Panel (Windows only).

Programs that support Steinberg's ASIO feature dialogs containing special settings for these drivers. The properties of the PHASE hardware can be set up in the ASIO Control Panel.



The ASIO settings

The ASIO buffer size has a direct effect on the latency ("speed") of the ASIO driver; if the value is too low it may impair the overall performance of your system, however. On fast systems (1 GHz or higher), you should be able to set values of less than 512 samples/buffer (this corresponds to a latency of less than 5 ms at 96 kHz) without problems.

"Without problems" means that you will not detect any dropouts during audio recording or playback. If dropouts occur, increase the buffer size or the number of samples per buffer.

The "conversion" into time values is displayed just below the menu.

GSIF/ASIO multi-client

To be able to use applications that use the different GSIF and ASIO driver models simultaneously (e.g. GigaStudio with Cubase SX), the GSIF/ASIO multi-client mode can be enabled. Two programs can thus share access to the hardware while you decide which output will be used by which application.

- **GSIF resolution.** Choose whether you prefer playback with 16- or 20/24-bit dynamics here. The bit depth you select here applies to ASIO as well as GSIF applications.
- **Buffer size.** Depending on the performance of your system, you can choose between small, standard and large buffers here. Select the buffer sizes “by ear” as described above—do dropouts occur, or do all of your applications work correctly?
- **Output selection.** Allocate the outputs to their respective drivers here.

Card(s) used for ASIO.

Here select the cards that are to be combined into “one card” in an ASIO combination—with cascaded EWS/PHASE systems. The highlighted cards then appear in the application as one (1) ASIO device with the corresponding number of inputs and outputs.

Colors (Windows only).

Here you can configure perhaps the most vital system settings within the PHASE Control Panel. No matter where you look, our days are filled with color. After all, life is beautiful, and there's nothing like pink buttons and delicate green reflections to breathe life and good cheer into your boring Windows desktop. Have fun...! ;-)

But seriously, folks—this section contains a number of truly useful settings that not only beautify your PHASE Control Panel, but which improve the overview of its display:

A click on the Background, Text, Static Controls and Peakmeter buttons opens the Windows dialog to change the colors.

The “Reflections off” option disables the attractive reflections of the elements. This can be helpful for slower systems.

Test the settings made above in the right-hand part of the window and save them when you're satisfied.

Once saved, you can find your personal color settings in the dropdown menu, which already contains a number of examples. The “Windows System” color set uses only colors that display correctly at an 8-bit color depth.

Additional tips on using the Control Panel.

- You can change the names displayed in the digital mixer area add clarity to your overview. Simply double-click WavePlay 1/2 ... 3/4 ... or Input 1/2 ... 3/4 ... and enter a new name (for example that of the connected device).
- Hover over one of the colorful VU meters briefly with the mouse cursor and the current peak signal level will be displayed.
- The VU displays can be disabled with a right-click to conserve system resources.
- A mute switch silences the relevant signal completely, whereas it can still be heard faintly when the fader has been pulled all the way down.
- The stereo link function (enabled by default) permits the left and right signals to be adjusted simultaneously.

Cascading and internal synchronization.

Up to 4 audio interfaces from TerraTec Producer (PHASE 88, PHASE 88 Rack, EWS 88 MT/D and EWS MIC 2/8) can be installed in a computer and run together as a closed system.

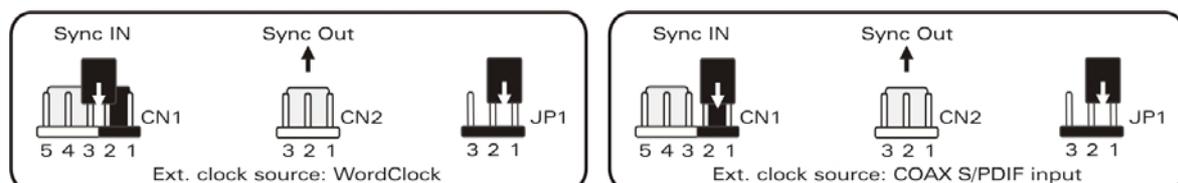
You can therefore conveniently increase the number of input and output channels which can also access directly from most Windows applications. A fully loaded system containing four PHASE and/or EWS models thus features a total of 40 inputs and outputs— and all of that with virtually the same low latency!

Before installing the individual PCI systems, you should give some thought to their future use. If you intend to use multiple systems together within a single application, for example under an ASIO and/or GSIF driver, these systems must be synchronized with one another. Synchronization means that the system clock of one card (master) controls all of the other cards (slaves). Ensure that the Sync input of one PHASE/EWS88 system is securely connected as a slave to the master card or an additional slave card via the cable connection (EWS Connect). The onboard digital input of the PHASE/EWS88 can no longer be used in this configuration (nor in independent mode). **TerraTec Audio products featuring WordClock interfaces such as the PHASE 88 rack system should be synchronized via WordClock.** The Sync-In on the associated EWS88 PCI card is therefore not connected. The advantage of this is that the digital inputs of all MIC modules are available separately in independent mode. Systems without WordClock interfaces must be connected to the master card internally via EWS Connect, however (see illustration: “Master/slave operation—synchronization of multiple PHASE/EWS systems”).

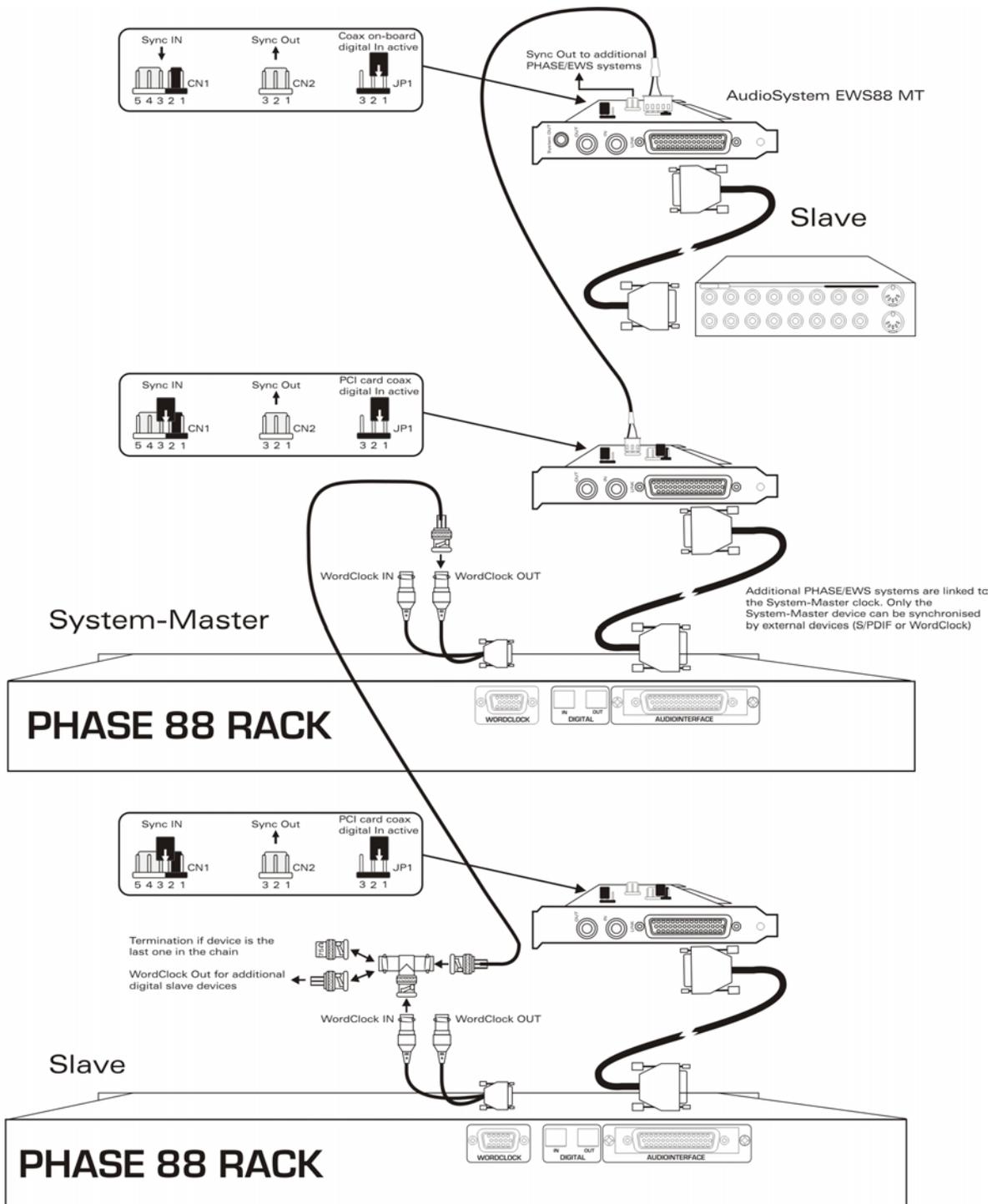
If you would like to use the systems in different applications (e.g. a PHASE 88 rack system under ASIO in Cubase SX and a PHASE 88 system under an MME application such as CoolEdit), we recommend not synchronizing the system via hardware connections. Master/slave operation would not be suitable in this case. As mentioned earlier however, all of the digital inputs of the individual systems are once again available in independent mode.

If you only have one card in your system, you will only need to specify the source (S/PDIF COAX or WordClock) of the external synchronization signal:

1. S/PDIF COAX: Sync IN → 1-2, Sync OUT open, JP 1 → 1-2.
2. WordClock: Sync IN → 2-3, Sync OUT open, JP 1 → 1-2.



Master/slave operation—synchronizing multiple PHASE/EWS systems



Master/slave mode

Once you have connected all of the systems electrically as described above, simply set the Multiple Card Mode in the PHASE Control Panel to “Master/Slave” for synchronized operation.

The PHASE Control Panel (or EWS Control Panel of older models) will now automatically configure the MasterClock settings, since the cards are now digitally synchronized. The clock of the first (master) card should now be set to “Internal”. All additional cards (you can select the models on the right-hand side of the Control Panel with “Select Card#”) are now set to external synchronization.

All interfaces will now run using the sampler frequency set on the master. If you would like to also use an external clock for the first card (using a DAT recorder, for example), set its master clock to “External” as well. The sync information are transmitted accordingly.

Tips, tricks & things worth knowing.

Multiple audio cards in a single system.

Modern PC systems can accommodate multiple audio cards from a variety of manufacturers and can run them in parallel. The extent to which the audio interfaces can be combined in practice depends on the software used. There are also generally no problems operating an onboard sound chip in parallel.

You have numerous connection options when using multiple audio systems from TerraTec. In short, all PCI cards of the TerraTec family can be operated together in a computer without any problems. This also applies for consumer products such as DMX 6fire 24/96 and others.

The PCI audio systems of the TerraTec Producer series (at printing time: EWS88 MT, EWS88 D, EWS MIC2+, EWS MIC8+, PHASE 88 and PHASE 88 Rack) can also be synchronized over an internal cable connection and configured over a common PHASE Control Panel. In an ASIO environment, the system is then displayed as a single device with up to 40 inputs and outputs. For more information on cascading the products see ➔ page 39.

About IRQs and other interrupts.

Basics:

IRQ stands for “Interrupt Request”. An IRQ is used to inform the processor that a device wants to perform a specific action. This is done over what are known as interrupt lines, which can stop the processor and demand it perform a calculation.

Since the introduction of the PIC (Programmable Interrupt Controller) a PC has 16 interrupt lines, most of which are already in use, as you can see below. More modern motherboards generally use an APIC (Advanced Programmable Interrupt Controller), which can manage more than 32 IRQs.

IRQ	Device
0	System timer
1	Keyboard
2	Cascaded for IRQ 8 to 15; from AT replaced by IRQ 9
3	Serial port (COM2)
4	Serial port (COM1)
5	Free
6	Disk drive controller
7	Parallel port (LPT1)
8	Real-time clock
9	Free
10	Free
11	Free
12	PS/2 Mouse
13	Mathematical coprocessor
14	Primary IDE controller
15	Secondary IDE controller

Unfortunately the computer does not run like that, because at that time a graphics card was not considered. In addition, most modern PCs have at least one USB controller, often a network, possibly a Raid controller and even onboard sound. As you can see, there is a shortage of IRQs, particularly if another card is installed in a PCI slot.

Please disable all devices that are not required (e.g. the COM ports are only rarely used) in the computer BIOS. See the documentation for your motherboard to do this. The “free” IRQs can now be used in the PCI bus.

PCI Bus:

There are generally only four “real” interrupt inputs available for the PCI bus, eight with modern motherboards with APIC. This means that even if you have six PCI slots on your motherboard, they have to make do with four or eight IRQs. The AGP port, USB and possibly the Raid controller also use these IRQs and with newer cards there is also onboard LAN, 1394 (FireWire) and SATA (serial ATA—new transfer standard for hard disks). It is impossible to avoid sharing an interrupt between multiple PCI slots. Unfortunately, there are no rules covering this and the motherboard documentation is the only refuge. Every motherboard has an IRQ table for the PCI bus; we will explain this assignment in more detail with the example of the “ABIT KT7A-Raid” and the “ASUS A7V8X”:

ABIT KT7A-Raid

Device	A	B	C	D
PCI Slot 1	shared	-	-	-
PCI Slot 2	-	shared	-	-
PCI Slot 3	-	shared	-	-
PCI Slot 4	-	-	-	shared
PCI Slot 5	-	-	shared	
PCI Slot 6				shared
AGP Slot	shared	-	-	-
USB Controller	-	-	-	shared
Raid Controller			shared	

A to D stands for the four available IRQs on the PCI bus.

- A is available for PCI slot 1 and AGP slot.
- B is available for PCI slot 2 and 3.
- C is available for PCI slot 5 and the Raid controller.
- D is available for PCI slot 4, 6 and the USB controller.

The result is that:

- PCI slot 1 and AGP slot share an IRQ
- PCI slot 2 and 3 share an IRQ
- PCI slot 4, 6 and USB controller share an IRQ
- PCI slot 5 and Raid controller share an IRQ

ASUS A7V8X

Device	A	B	C	D	E	F	G	H
PCI Slot 1	-	-	-	shared	-	-	-	-
PCI Slot 2	shared	-	-	-	-	-	-	-
PCI Slot 3	-	shared	-	-	-	-	-	-
PCI Slot 4	-	-	shared	-	-	-	-	-
PCI Slot 5	-	-	-	shared	-	-	-	-
PCI Slot 6	shared	-	-	-	-	-	-	-
AGP Slot	shared	-	-	-	-	-	-	-
USB 1.1 UHCI 1	-	-	-	-	-	shared	-	-
USB 1.1 UHCI 2	-	-	-	-	-	shared	-	-
USB 1.1 UHCI 3	-	-	-	-	-	shared	-	-
USB 2.0 EHCI	-	-	-	-	-	shared	-	-
AC 97 Codec	-	-	-	-	-	-	used	-
Onboard LAN	-	-	shared	-	-	-	-	-
Onboard 1394	-	shared	-	-	-	-	-	-
Onboard SATA	-	shared	-	-	-	-	-	-
Onboard IDE	-	-	-	-	used	-	-	-

A to H stands for the eight available IRQs on the PCI bus.

- A is available for PCI slot 2, 6 and the AGP slot.
- B is available for PCI slot 3, onboard 1394 (FireWire) and SATA.
- C is available for PCI slot 4 and onboard LAN.
- D is available for PCI slot 1 and 5.
- E is available for the IDE controller.
- F is available for the USB controllers.
- G is available for AC 97 sound chip.
- H is not used.

The result is that:

- PCI slot 2, 6 and AGP port share an IRQ.
- PCI slot 3, onboard 1394 (FireWire) and SATA share an IRQ.
- PCI slot 4 and onboard LAN share an IRQ.
- PCI slot 1 and 5 share an IRQ.
- the IDE controller has its own IRQ.
- the USB controllers have their own IRQ.
- the AC97 sound chip has its own IRQ.

As you can see the installation position has a great influence on the IRQ assignment in the system, and to assign an IRQ to a device you can, for example, use the second PCI

slot on the ABIT board but then you must leave the third free. For example, on the ASUS board that would be slots 1 and 5.

To check the IRQ assignments in your system, open the Device Manager in Windows 98 and ME, double-click System, and you will find the IRQ list there. In Windows 2000 and XP the Control Panel does not usually show the IRQ assignments correctly because of virtual CPI IRQ assignments. In these operating systems you must view the PCI Device List, which appears briefly during the boot process. The “actual” IRQ assignments are shown there, but with modern PCs there is usually no time to look at the list during startup, because it appears and disappears much too quickly. Tip: select the floppy disk drive as the first boot device and insert an empty diskette. When the error message warning of a missing operating system appears, you will also be able to see the PCI Device List ;-).

Exclusive or shared IRQ?

Basically, all modern PCI cards with WDM drivers support IRQ sharing, but under some circumstances this can cause problems. For example, if the sound card requests an interrupt request during playback or recording of an audio file but the request cannot be carried out immediately, perhaps because the ISDN card is also using this IRQ and the IRQ controller must first query which device is actually requesting the IRQ, this can cause interference like static and crackling as a result of missing samples.

Our hearing is (fortunately) one of our most sensitive organs and therefore every sample that is missed during playback is immediately obvious. Your eyes would not even notice a brief delay during web surfing caused by the ISDN card not reacting immediately, but your ears are less forgiving. So this applies for sound cards: give it its own IRQ to keep your ears happy!

Always right on time—digital synchronization.

When recording with the digital interface, make sure that the sampling frequency (rate) of the card matches that of the device from which you are recording. To ensure correct synchronization of the devices, you must switch the MasterClock to “External” in the PHASE Control Panel (see also page ➔ 30).

If you forget this step, audible errors such as dropouts and clicks may occur during recording—and already when monitoring the signal. And also in the reverse situation (an external device should run at the same rate as the audio system), make sure that settings of your additional peripherals match. The PHASE Control Panel must be set to “Internal” in this case (such as during operation without externally connected digital devices). If the devices are to be permanently connected to one another in both directions, you must decide which device will provide the clock signal.

The digital interface of the PHASE 88 audio system transfers all bit resolutions between 8 and 24 bits and all sampling rates between 8 and 96 kHz. Please note that not all devices

can process sample rates higher than 48 kHz. To transfer a signal recorded at 96 kHz to a DAT recorder, it's necessary to use suitable software to convert the file(s) to 44.1 kHz or 48 kHz first.

Dolby AC3 and DTS.

The digital interfaces of the PHASE 88 Rack system can also be used independently of the S/PDIF standard (see also ➔ page 30; S/PDIF Out at “Non-audio”). Various manufacturers of software DVD players support playback of DVD studio material over the PHASE series of TerraTec Producer. Signals in Dolby AC3 or DTS format can therefore also be transferred using the digital interfaces.

Useful information about digital cables (optical waveguides and AES/EBU).

Even when transmitting audio data via optical fibers, a few, usually inaudible, errors may occur. You should therefore be sure to use high-quality cables that are not too long: flexible plastic cables should have a maximum length of 1.5 m, the less-flexible glass fiber cables may be up to 5 m long.

Audio differences with digital cables seem improbable at first glance, but they can happen nevertheless. This is due to the fact that error correction algorithms are obviously used more frequently at some times than at others to compensate for quality differences between individual cables. However, these audio losses are usually so minimal that you need to be careful not to mix up the myth with the reality. If you're interested, there are a number of somewhat entertaining militant newsgroups dealing with this subject on the Internet ;-).

Devices with AES/EBU interfaces cannot normally be used on S/PDIF interfaces—ambitious tinkering with simple adapter plugs will not get you anywhere. As the AES/EBU protocol is nearly identical to S/PDIF and the transmission essentially only differs in the signal strength, you can make your own converter with a bit of soldering.

Appendix A—Technical Data

19" module

- External 19" unit (1U) plus PCI interface card
- 8 balanced analog inputs, 1/4" jack
- 8 balanced analog outputs, 1/4" jack
- 8 gain controllers on the front for setting levels for analog inputs.
- Range from –18 dBu (approx. 100 mV) to +15 dBu (approx. 4.4 V)
- 8 input signal and clipping LEDs on the front panel
- 2 XLR/jack Mic INs on the front panel as alternatives to inputs 7 and 8
- Inputs 7 and 8 switchable between microphone and line/instrument levels
- Switchable 48 V phantom power for microphone inputs
- External power adapter, 230 V/50 Hz (Euro, UK) or 110 V/60 Hz to 12 V AC
- 2 separate MIDI interfaces (5-pin DIN)
- 24-bit/96 kHz A/D converter with 100 dB (A) SNR*, 102 dB(A) typical @ 48 kHz
- 24-bit/96 kHz D/A converter with 110 dB (A) SNR*, 108 dB(A) typical @ 48 kHz
- WordClock I/O with autodetection

PHASE 88 PCI board

- PCI interface board
- Bus master transfer supports 24-bit 4-byte mode (32 bit)
- 10 inputs and outputs total
- Simultaneous recording and playback of up to 20 channels in 24-bit/96 kHz
- Digital input with 2 channels (S/PDIF, coax at up to 24-bit / 96 kHz)
- Digital output with 2 channels (S/PDIF, coax at up to 24-bit / 96 kHz)
- 20 channel mixer with 36-bit internal resolution
- EWS Connect** connection
- Non-audio mode for transmitting AC3/DTS streams via digital interfaces.
- Hardware VU meter for every channel on the Control Panel display
- 4 meter connecting line to MIC module

* This information refers to the technical data of the converters being used.

** Audio systems with an EWS Connect connection can be cascaded and synchronized. You can control up to four systems in one PC with only one driver and only one Control Panel.

Software

- WDM drivers for Windows 98SE/ME/2000 and Windows XP
- Core Audio/MIDI driver for MAC OS 10 (X)
- PC support for ASIO 2.0 and GigaStudio (GSIF)
- ASIO/GSIF multi-client mode
- WDM kernel streaming (e.g. for Sonar™)
- MME and DirectSound support
- Control Panel for Windows 98SE/ME/2000, Windows XP and MAC OS 10

System requirements PC

- Pentium II 450 or higher
- VGA video card, 800x600 / 256 colors
- 128 MB RAM
- Windows 98SE/ME/2000 or Windows XP

System requirements – MAC

- G3 800 MHz
- VGA video card, 800x600 / 256 colors
- 256 MB RAM
- OS X

System recommendations – PC

- Intel Pentium III 1 GHz, Celeron 900 MHz or AMD K7 Athlon 1 GHz
- ULTRA DMA or SCSI controller
- VGA video card, 1024x768 / HiColor
- 256 MB RAM

System recommendations – MAC

- G4 1GHz
- VGA video card, 1024x768 / HiColor
- > 256 MB RAM.
- MAC OS X Jaguar >= 10.2.