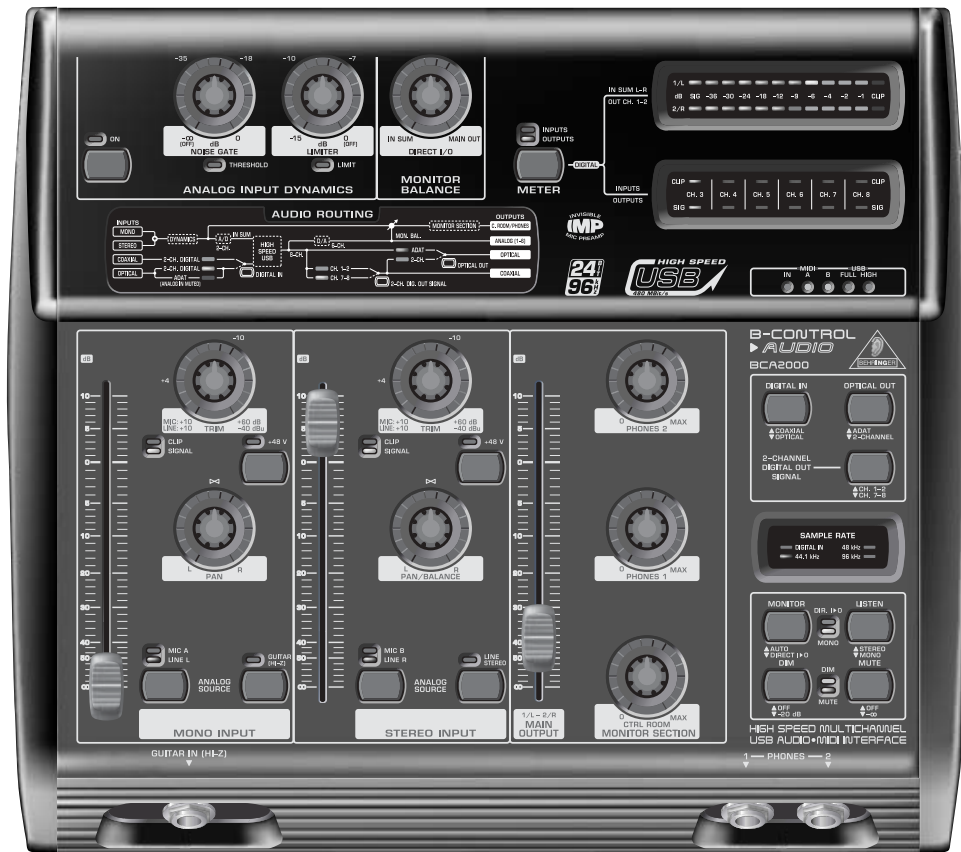


B-CONTROL ► AUDIO BCA2000

User's Manual

Version 1.0 February 2004

ENGLISH



B-CONTROL ► AUDIO BCA2000

IMPORTANT SAFETY INSTRUCTIONS



CAUTION: To reduce the risk of electric shock, do not remove the top cover (or the rear section). No user serviceable parts inside; refer servicing to qualified personnel.

WARNING: To reduce the risk of fire or electric shock, do not expose this appliance to rain and moisture.




This symbol, wherever it appears, alerts you to the presence of uninsulated dangerous voltage inside the enclosure—voltage that may be sufficient to constitute a risk of shock.



This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Please read the manual.

DETAILED SAFETY INSTRUCTIONS:

- 1) Read these instructions.
 - 2) Keep these instructions.
 - 3) Heed all warnings.
 - 4) Follow all instructions.
 - 5) Do not use this apparatus near water.
 - 6) Clean only with dry cloth.
 - 7) Do not block any ventilation openings. Install in accordance with the manufacturer's instructions.
 - 8) Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
 - 9) Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.
 - 10) Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit the unit.
 - 11) Only use attachments/accessories specified by the manufacturer.
 - 12) Use only with the cart, stand, tripod, bracket, or table specified by the manufacturer, or sold with the apparatus. When a cart is used, use caution when moving the cart/apparatus combination to avoid injury from tip-over.
- 
- 13) Unplug this apparatus during lightning storms or when unused for long periods of time.
 - 14) Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.

B-CONTROL ► *AUDIO*

High-Speed USB 2.0 Multi-Channel Audio/MIDI Control Interface with ADAT® Support, Surround Outputs and Extensive Monitor Control Section

- ▲ High-performance analog input section with 2 state-of-the-art studio-grade IMP “Invisible” Mic Preamps, +48 V phantom power plus line and Hi-Z guitar inputs
- ▲ Ultra-flexible input/output configuration supported by a comprehensive LED audio routing indicator plus button (status) LEDs
- ▲ Adjustable studio-grade analog input dynamic control (noise gate + limiter) prevents distorted input signals or A/D converter overload
- ▲ Fully equipped USB/MIDI interface with 1 MIDI In/2 MIDI Outs individually selectable for 16 / 32 MIDI channels
- ▲ Versatile digital input and output formats like ADAT®, ADAT® S/MUX, AES/EBU and S/PDIF, including DOLBY DIGITAL® and DTS® support
- ▲ Simultaneous use of 3 analog input sources (1 mono + 1 stereo), digital input sources plus full multi-channel playback @ 24-bit/96 kHz
- ▲ High-resolution 2 x 12 element LED level indicator for stereo In / Out signals plus 2-element LED level indicator for input and output channels 3 - 8
- ▲ High-speed USB 2.0 interface with 24-bit/96 kHz supports 8 In + 8 Out channels simultaneously (analog and digital) with low latency ASIO 2 & WDM drivers
- ▲ Fully equipped master and monitor sections with 100-mm faders, individual level controls for 2 speakers, 2 phones and direct monitor function plus separate dim, mute and mono functions
- ▲ High-quality components and exceptionally rugged construction for long life and durability
- ▲ Designed in Germany. Manufactured under ISO9000 certified management system

FOREWORD



Dear Customer,

welcome to the team of BCA2000 users, and thank you very much for expressing your confidence in us by purchasing the B-CONTROL.

Writing this foreword for you gives me great pleasure, because it represents the culmination of many months of hard work delivered by our engineering team to achieve a very ambitious goal: to deliver an outstanding USB audio/MIDI control interface, whose extremely flexible connections let it assume

the central control role in almost any computer studio. The task of designing our new B-CONTROL certainly meant a great deal of responsibility, which we assumed by focusing on you, the discerning computer user and musician. Meeting your expectations also meant a lot of work and night shifts. But it was fun, too. Developing a product usually brings a lot of people together, and what a great feeling it is when all who participated in such a project can be proud of what they've achieved.

It is our philosophy to share our enjoyment with you, because you are the most important member of the BEHRINGER team. With your highly competent suggestions for new products you've made a significant contribution to shaping our company and making it successful. In return, we guarantee you uncompromising quality as well as excellent technical and audio properties at an extremely reasonable price. All of this will enable you to give free rein to your creativity without being hampered by budget constraints.

We are often asked how we manage to produce such high-quality equipment at such unbelievably low prices. The answer is quite simple: it's you, our customers! Many satisfied customers mean large sales volumes enabling us to get better purchasing terms for components, etc. Isn't it only fair to pass this benefit on to you? Because we know that your success is our success too!

I would like to thank all of you who have made the B-CONTROL possible. You have all made your own personal contributions, from the developers to the many other employees at this company, and to you, the BEHRINGER user.

My friends, it's been worth the effort!

Thank you very much,

Uli Behringer

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1. INTRODUCTION

Welcome to the family of BCA2000 users and thank you for expressing your confidence in BEHRINGER products by purchasing the B-CONTROL.

The BCA2000 is an extremely flexible USB audio and MIDI interface with a unique design concept that will effectively support you in your computer-based music and audio endeavors.


Our goal in designing the B-CONTROL was to create an intuitive, flexible and optically attractive product that gives you comfortable control (instead of those tiny knobs and buttons found on so many interfaces) and plenty of connectivity options, so that you can concentrate on what's really important: your music. That's why we started by creating a mixing console with a clean, concise layout: ultra-precise 100-mm faders, a high-resolution LED level display, rugged construction, our ultra low-noise IMP "invisible" microphone preamplifiers and an extensive monitor section—features you've come to expect from a BEHRINGER mixing console. Then we added a multitude of interface functions: full 24-bit/96 kHz support in multichannel operation, optical and coaxial digital connectors that support all common formats, simultaneous reproduction of eight input and eight output channels, 6 analog outputs for subgroup/stem or 5.1 surround reproduction and a simultaneously usable USB MIDI interface. All of this makes the BCA2000 a one-of-a-kind high-speed USB audio/MIDI interface featuring a comfortable mixing console design.


 **The following user's manual is intended to familiarize you with the unit's control elements, so that you can master all the functions. After having thoroughly read the user's manual, store it at a safe place for future reference.**


1.1 Before you get started


1.1.1 Shipment


The BCA2000 was carefully packed at the assembly plant to assure secure transport. Should the condition of the cardboard box suggest that damage may have taken place, please inspect the unit immediately and look for physical indications of damage.

 **Damaged equipment should NEVER be sent directly to us. Please inform the dealer from whom you acquired the unit immediately as well as the transportation company from which you took delivery. Otherwise, all claims for replacement/repair may be rendered invalid.**

 **To assure optimal protection of your B-CONTROL during use or transport, we recommend utilizing a carrying case.**

 **Please always use the original packaging to avoid damage due to storage or shipping.**

 **Never let unsupervised children play with the B-CONTROL or with its packaging.**

 **Please dispose of all packaging materials in an environmentally friendly fashion.**

1.1.2 Initial operation

Please make sure the unit is provided with sufficient ventilation, and never place the B-CONTROL on top of an amplifier or in the vicinity of a heater to avoid the risk of overheating.


A power supply unit which meets the necessary safety requirements is enclosed for connecting the B-CONTROL to the mains.

1.1.3 Warranty

Please take a few minutes and send us the completely filled out warranty card within 14 days of the date of purchase to assure unproblematic warranty processing in the future. You may also register online at www.behringer.com. The serial number needed for the registration is located at the bottom of the unit. Failure to register your product may void future warranty claims.

1.2 System requirements

Operating system	Windows® XP
Computer	Windows® PC with USB connector
Processor	Intel Pentium Processor 1.2 GHz or better
Chip set	Intel chip set recommended
USB modes	Full eight-channel input/output operation with 24-bit/96 kHz with USB 2.0 interface (High-Speed USB, 480 Mbps)

 **When connecting to a Full-Speed USB interface (12 Mbps, also known as USB 1.1), only limited operation is possible (see 1.2.2).**

1.2.1 Outline of functions for High-Speed USB (USB 2.0)

Audio inputs:

- ▲ Simultaneous recording of three analog signals (1 x mono, 1 x stereo) and one stereo digital signal.
- ▲ Alternatively, simultaneous recording of eight audio channels at 44.1 kHz or at 48 kHz with the optical input in ADAT® format (four-channel recording at 24-bit/96 kHz with ADAT® S/MUX).
- ▲ Support for S/PDIF, AES/EBU, ADAT®, and ADAT® S/MUX digital audio formats.

Audio outputs:

- ▲ Simultaneous reproduction of eight output signals (six analog and one stereo digital signal). The stereo digital output signal is available in parallel on both the coaxial and optical outputs.
- ▲ Alternatively, reproduction of eight digital signals at 44.1 or 48 kHz via the optical output in ADAT® format (four-channel reproduction at 24-bit/96 kHz with ADAT® S/MUX), also available in parallel on analog outputs 1 to 6 and the coaxial digital output.
- ▲ Support for S/PDIF, AES/EBU, ADAT®, ADAT® S/MUX, DOLBY® DIGITAL and DTS® digital audio formats.

MIDI:

- ▲ Simultaneous use of all MIDI inputs and outputs.

1.2.2 Outline of functions for Full-Speed USB

Audio inputs:

- ▲ Simultaneous recording of three analog signals (1 x mono, 1 x stereo) and one stereo digital signal.
- ▲ Alternatively, simultaneous recording of four ADAT® channels at 44.1 and 48 kHz.
- ▲ Support of S/PDIF, AES/EBU and ADAT® digital audio formats.

Audio outputs:

- ▲ Simultaneous reproduction of two stereo signals, available in parallel on the analog and digital outputs.
- ▲ Alternatively, reproduction of four ADAT® channels at 44.1 kHz or 48 kHz via the optical output, also available in parallel on all analog outputs and on the coaxial digital output.
- ▲ Support of S/PDIF, AES/EBU, ADAT®, DOLBY® DIGITAL and DTS® digital audio formats.

MIDI:

- ▲ Additionally, simultaneous use of all MIDI functions.

2. INSTALLATION

2.1 Driver installation—Part 1

Start your Windows® XP computer and insert the BEHRINGER driver CD.

Install the Microsoft Hotfix Patch:

- ▲ In Windows Explorer, select the CD/DVD drive in which the BEHRINGER driver CD is located
- ▲ Open the “KB822603” folder
- ▲ Double-click the **command file** in your language (e.g. “English.CMD”)
- ▲ Follow the instructions in the dialog box by clicking “Next >”
- ▲ After the final step, click “Finish”. The computer will now restart.

2.2 Hardware connection/ driver installation—Part 2

Connect your computer via USB to the BCA2000 and power up the B-CONTROL. The “Found New Hardware Wizard” opens up.

- ▲ Select “Install from a list or specific location (Advanced)” and click “Next >”
- ▲ Select “Search for the best driver in these locations”
- ▲ Check the “Include this location in the search” box and click “Browse”
- ▲ Select the CD/DVD drive with the BEHRINGER driver CD and the folder “Drivers”* and click “Next >”
- ▲ If you now get an error message (“Driver software has not passed Windows Logo testing”), ignore the message and click on “Continue anyway” (whether or not you get the error message depends on the configuration of your computer)
- ▲ After software installation is complete, the “Behringer BCA2000 bootloader” prompt appears; click “Finish”.

The “Found New Hardware Wizard” will automatically start again. This procedure is almost identical to the previous one:

- ▲ Select “Install from a list or specific location (Advanced)” and click “Next >”
- ▲ Select “Search for the best driver in these locations”
- ▲ Select the “Include this location in the search” box and click “Browse”
- ▲ Select the CD/DVD drive with the BEHRINGER driver CD and the folder “Drivers”* and click “Next >”
- ▲ If you get the same error message again (“Driver software has not passed Windows Logo testing”), ignore the message and click on “Continue anyway” (again, whether or not you get the error message depends on the configuration of your computer)
- ▲ After software installation is complete, the “BEHRINGER BCA2000” prompt appears; click on “Finish”.

After another computer restart, a small BCA2000 control panel icon appears in the task bar (“Task Bar Notification Area”). This concludes the installation procedure.

*If you downloaded the driver from the internet, you will first need to decompress the file. During installation, select the location on your hard drive where you saved the decompressed driver.

2.3 Control panel software

The control panel software gives you access to all global B-CONTROL settings and is integrated into your computer system during driver installation. To launch the control panel software, click on the BCA2000 control panel symbol in the task bar at the bottom right of your screen.

Any changes to settings in the control panel are immediately effective, with the exception of the “Driver Latency/Buffer Size” setting: if you move the fader, a message pops up informing you that the new latency/buffer size setting will be effective after you close the control panel.

ADAT® 96 kHz operation is indicated in all windows (right field), along with the current sample rate, ASIO and USB driver version and firmware version.

The following settings can be made in the **Setup window**:

Fig. 2-Ch. Output Format: The format for two-channel digital output is switchable between **AES/EBU** and **S/PDIF**. Format selection has an effect on both the coaxial and the optical output, unless the OPTICAL OUT button ([22]) is set to “ADAT”.

Clock Select: Selects a wordclock synchronization source. **DIG. 2-CH./ADAT** enables external synchronization via the optical or coaxial input (which input serves as the synchronization source is determined by the DIGITAL IN button ([21]). ADAT® synchronization is only possible via the optical input with an ADAT® signal present. To synchronize to a 96 kHz signal, select **S/MUX (ADAT IN)**. When set to **INTERNAL**, the BCA2000 synchronizes itself to the sample rate selected in your audio software.

MIDI Port B Select: In this field, MIDI OUT B can be configured as a MIDI THRU. When **THRU** mode is activated, this output forwards incoming data with no additional processing. If **OUT** is selected, the OUT B/THRU connector can be addressed by the computer as a second MIDI output, giving you a total of 32 MIDI channels.

ASIO Direct Monitoring: This setting determines which signal is monitored during recording. If **Digital** is selected, only the input signal will be heard with no latency (delay). In **Analog** mode, both the recorded tracks and the input signal (the signal being recorded) are heard simultaneously; the mix between the two can be adjusted via the MONITOR BALANCE fader ([19]). In both modes, only the output signal is heard when the audio software is in playback mode. Switching between recording and playback mode is accomplished via your audio software.

Driver Latency/Buffer Size: Here you can adjust the latency (system-inherent audio signal delay) in order to optimize your computer’s performance. The lower the latency (and consequently the buffer size), the higher the CPU usage. When the processor workload is too high, you will notice frequent pauses in audio playback (as the processor catches up). If you change this setting, a message will appear stating that your changes will take effect only after you close the control panel.

The **USB INFO window** (fig. 2.2) allows you to adapt the B-CONTROL to the USB connection you are using. If you are running your B-CONTROL on Full-Speed USB, only limited functionality is available. The table shows which input/output combinations are possible with your USB interface.

The **BLOCK DIAGRAM window** (fig. 2.3) shows the entire audio signal flow of your BCA2000 and serves as a good source of information if you don’t have the user’s manual handy.

B-CONTROL ► AUDIO BCA2000

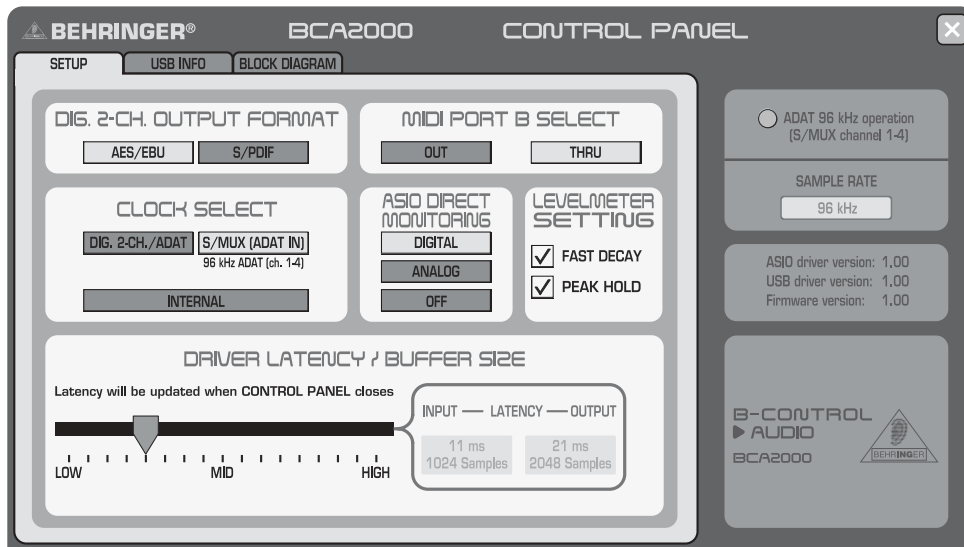


Fig. 2.1: Control panel software SETUP window

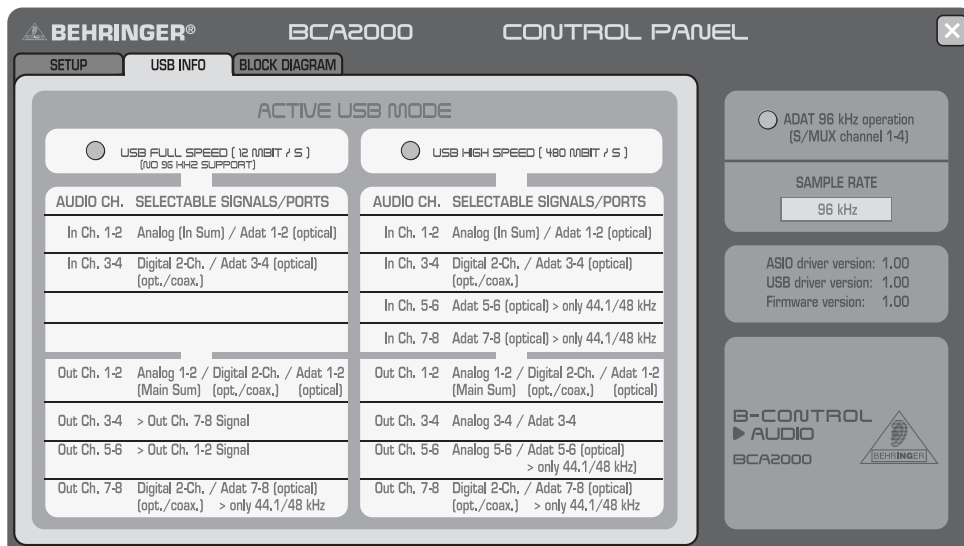


Fig. 2.2: Control panel software USB INFO window

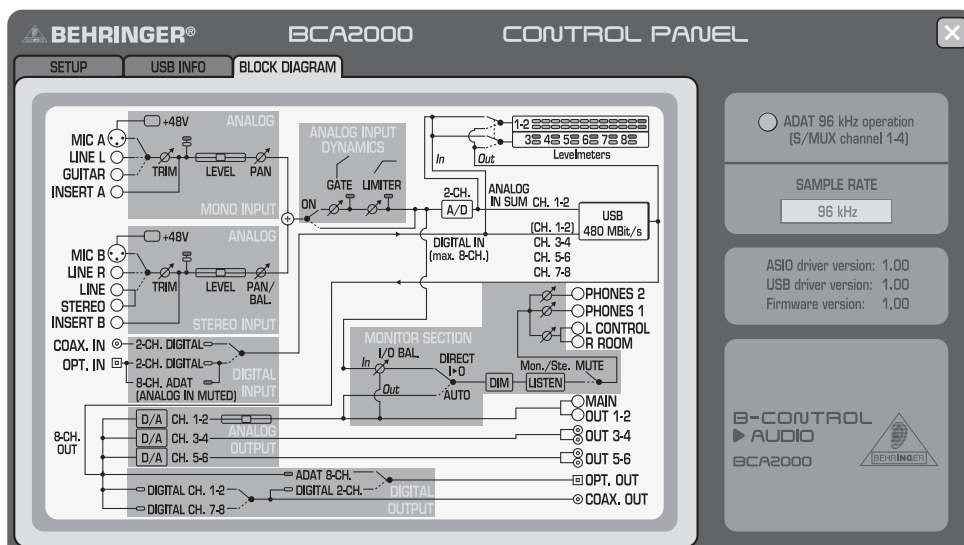


Fig. 2.3: Control panel software BLOCK DIAGRAM window

3. CONTROL ELEMENTS AND CONNECTIONS

The various control elements of your BCA2000 are described in this chapter. All controls and connections are explained in detail, and there are several useful tips on their use.

3.1 Control surface

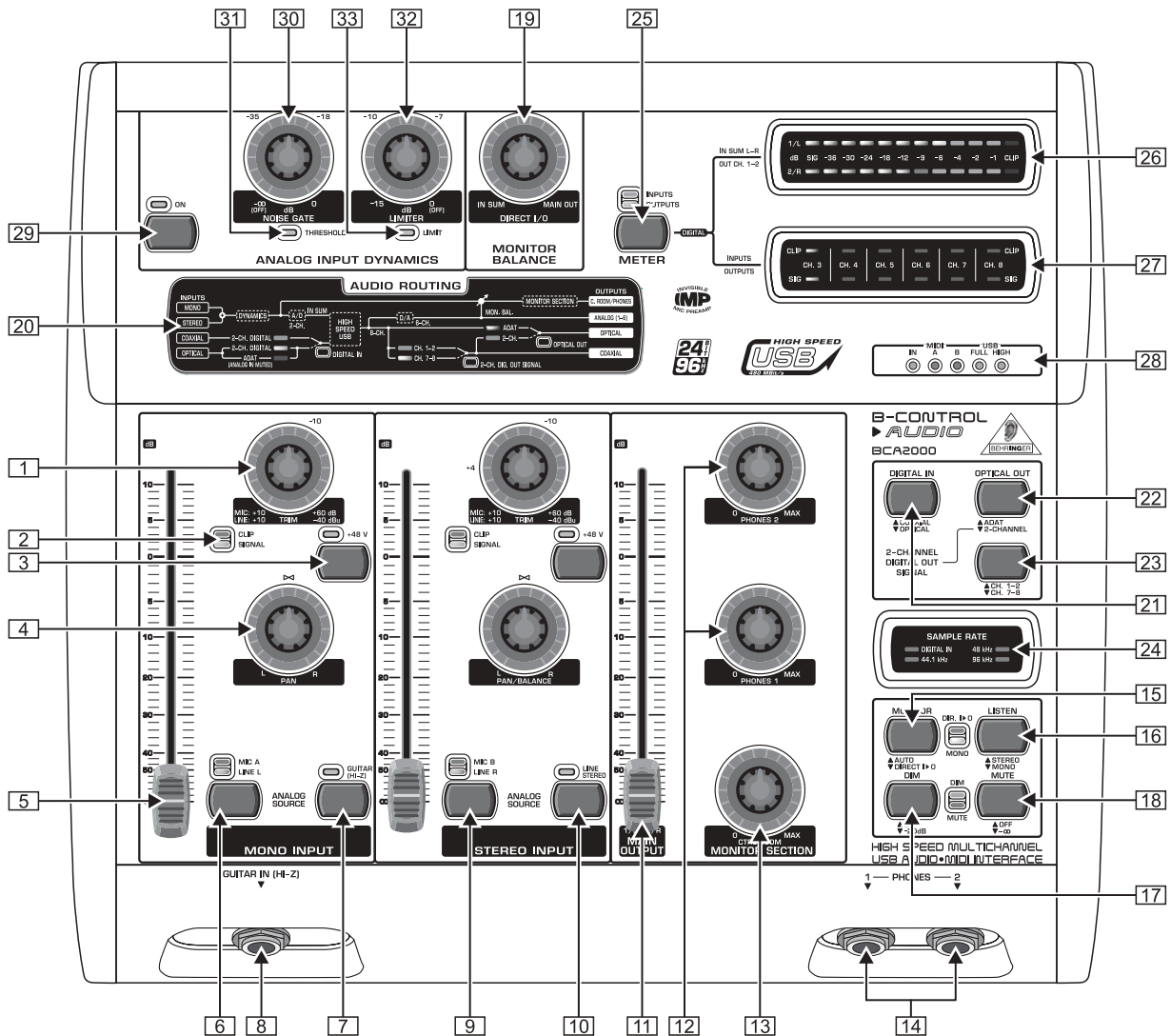


Fig. 3.1: The BCA2000's control elements

3.1.1 Input section

- 1 The *TRIM* control adjusts the level of input signals.
- 2 The *CLIP* and *SIGNAL* LEDs show the input signal level. *SIGNAL* illuminates when there is an incoming signal, whereas *CLIP* illuminates when the level is too high and could cause distortion. If this happens, turn the *TRIM* control counterclockwise slightly and the *CLIP* LED no longer illuminates.
- 3 The *+48 V* button activates phantom power for a condenser microphone connected to the XLR input.
- 4 **Be sure to mute your audio system before you activate the phantom power supply to prevent audible and potentially damaging switch-on thumps from reaching your monitor speakers.**
- 4 *PAN* positions the signal in the stereo field. If the *LINE STEREO* button [10] is pressed, the *PAN* control adjusts the *BALANCE* between L and R signals in the stereo input channel.
- 5 The 100-mm channel faders control the level of the input signal that is routed to the A/D converter.
- 6 *MIC A* and *LINE L* are the two possible positions of this switch, which controls the input that is routed to a particular channel. The corresponding LEDs indicate the input you selected. If *GUITAR HI-Z* switch [7] is pressed, the left *MIC A/LINE L* switch is deactivated.
- 7 The *GUITAR (HI-Z)* button feeds the guitar signal from the guitar input [8] into the mono input channel. This button overrides the *MIC A/LINE L* button [6]: when *GUITAR (HI-Z)* is activated, *MIC A* or *LINE L* can no longer be selected.
- 8 The *GUITAR IN (HI-Z)* input allows you to directly connect an electric guitar or other high-impedance signal (e.g. passive pickups of acoustic instruments).
- 9 *MIC B/LINE R* is the input selection button for the stereo input channel. Select between *MIC B* and *LINE R* (the right line input). The corresponding LEDs indicate the selected input.

[10] The *LINE STEREO* button feeds the stereo signal of both line inputs ([41]; see page 10) into the stereo input channel.

If the *LINE STEREO* button [10] is pressed, channel two becomes a stereo channel, and the *PAN* control assumes the *BALANCE* function (see 4 above). This allows a maximum of three input signals (1 x mic/guitar and 1 x stereo) to be processed simultaneously (see also ch. 4.1).

3.1.2 Main/Monitor section

[11] The 100-mm *MAIN* fader controls the output signal (*MAIN OUT*).

[12] The *PHONES* controls adjust the volume of connected headphones.

[13] The *CTRL ROOM* control adjusts the volume of the control room outputs [40].

[14] The *PHONES* outputs (individually adjustable; see 12) are used for connecting headphones. You can listen to the main output, the input sum or the mix of both signals.

[15] The *MONITOR* button activates the direct monitoring function, and the *DIR I/O* LED lights up. When the button is not pressed, auto monitoring is active.

With auto monitoring, switching between input and recorded tracks is done automatically by your host software (audio sequencer/software mixer). System-induced latencies occur between the recorded signal and computer playback. To avoid this, you can switch to *DIRECT I/O* during a recording session. This provides you with delay-free signal routing (see also ch. 4.3).

[16] *LISTEN* switches the monitor signal (control room and phones) to mono (e.g. to check mono compatibility).

[17] *DIM* lowers the level of phones and control room outputs by -20 dB.

[18] The *MUTE* button mutes the phones and control room outputs.

[19] The *MONITOR BALANCE* control adjusts the volume balance between the input sum and the output signal (main out). The control is only active if the *MONITOR* button [15] is pressed (direct monitoring).

[20] The *AUDIO ROUTING* diagram shows the audio signal flow of your B-CONTROL. The integrated LEDs show the current selection of inputs and the status of buttons [21] - [23].

[21] The *DIGITAL IN* button lets you select a digital input source ("COAXIAL" or "OPTICAL").

[22] *OPTICAL OUT* selects the format for the optical output [37]. Available choices are "ADAT" (eight-channel or four-channel with "ADAT S/MUX") and "2-CHANNEL".

[23] *CH. 1-2/CH. 7-8* button: if *OPTICAL OUT* is set to "2-CHANNEL", the *CH. 1-2/CH. 7-8* button lets you select which USB output channels are played back via the digital optical and coaxial outputs. If *OPTICAL OUT* is set to "ADAT", the *CH. 1-2/CH. 7-8* setting only applies to the coaxial output.

The status LEDs for buttons [21] to [23] are located in the audio routing diagram [20].

[24] *SAMPLE RATE* LEDs: All digital inputs and outputs have the same sample rate, which is determined by your host software (unless you are synchronizing to an external wordclock source). If you change the sample rate in the software, the display on your BCA2000 automatically switches to the new value. For example, if you select 44.1 kHz in your software, the *44.1 kHz* LED illuminates. If an external wordclock signal is connected, the *DIGITAL IN* LED illuminates. If this external signal also has a sampling rate of 44.1 kHz, both the *44.1 kHz* and the *DIGITAL IN* LEDs will illuminate.

[25] The *METER* button lets you switch the LED level meters ([26] and [27]) between input and output signals.

[26] The LED level meter displays either the input sum signal post-A/D converter or the digital output signal pre-main fader, depending on the position of the *METER* button [25].

[27] The LEDs for channels 3 - 8 indicates signal presence in the digital channels 3 - 8 (green *SIG* LEDs) or if levels are too high and may cause distortion (red *CLIP* LEDs).

[28] These status LEDs display the following:

MIDI IN, *OUT A* and *OUT B* illuminate if MIDI signals are present at the respective connectors.

USB FULL and *USB HIGH* LEDs indicate status and type of the USB connection. The appropriate LED will remain illuminated as long as your BCA2000 is connected to your computer via USB (and the computer is powered up).

3.1.3 Dynamics section

Your BCA2000 features a combined noise gate/limiter (dynamics) section for the analog input signal. This section is located directly pre-A/D converters.

[29] The *ON* button activates the dynamics section.

[30] The *NOISE GATE* control adjusts the threshold or signal level below which the noise gate is activated; signals below this level are muted. Turning the *NOISE GATE* control fully counterclockwise ($-\infty$) deactivates the noise gate.

[31] When the level of a signal falls below the threshold value, this red *THRESHOLD* LED illuminates (noise gate active).

[32] The limiter limits the signal to a maximum level, which can be adjusted. Turning the *LIMITER* control fully clockwise deactivates the limiter.

[33] The *LIMIT* LED illuminates when the limiter is active.

✎ If you only want to use the noise gate, set the *LIMITER* control to zero (fully clockwise). If you only want to use the limiter, turn the *NOISE GATE* control to $-\infty$ (fully counterclockwise).

✎ The noise gate/limiter section works in fixed stereo, i.e. the left and right channels always function jointly. When processing two mono signals, these signals may be processed inaccurately.

3.2 The rear panel

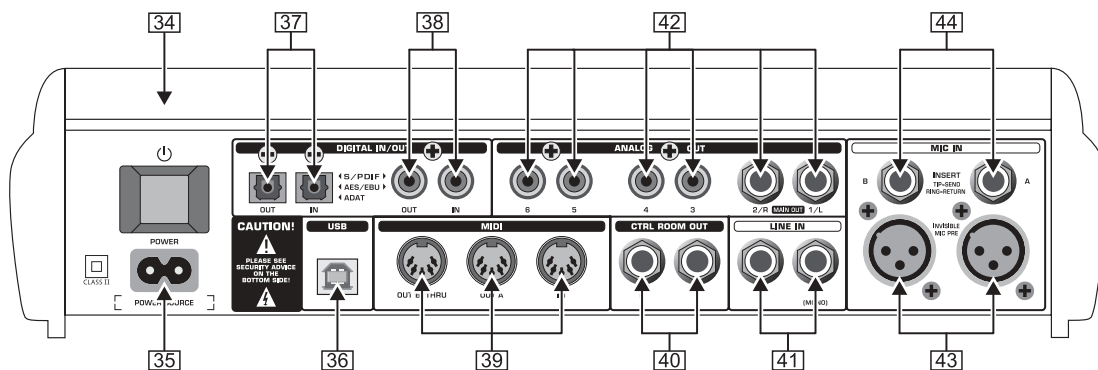


Fig. 3.2: The BCA2000's connectors

- [34] The **POWER** switch turns your BCA2000 on and off. It should always be in the OFF position (out) when connecting the unit to or disconnecting the unit from the mains.
- 👉 **Please note: The power switch does not completely separate your BCA2000 from AC power. If you plan on not using your BCA2000 for a prolonged period of time, please disconnect it from the mains by removing the power cable from the wall outlet.**
- [35] A standard power socket is provided for connection to the mains. A matching power cable is included with the unit.
- [36] **USB** port. Connect your computer here. To get the most out of your B-CONTROL, your computer's USB interface should support High-Speed USB.
- [37] / [38] **DIGITAL IN/OUT:**
- [37] The **OPTICAL** digital input and output accept all standard formats, including ADAT®.
- [38] The **COAXIAL** (RCA) input and output accept digital audio signals in all standard formats.
- [39] **MIDI** interface. **MIDI OUT B** can be configured as a MIDI Thru in the control panel software.
- [40] Connect the **CONTROL ROOM OUTS** to your active studio monitors or amplifier. These outputs deliver the same signal as the headphone outputs.
- [41] **LINE IN**. The line inputs are supplied as 1/4" TRS connectors. You can also connect unbalanced connectors (mono 1/4") to these inputs.
- [42] **ANALOG OUT:** the **MAIN OUTS** 1/L and 2/R deliver the MAIN OUT signal and are supplied as balanced 1/4" TRS connectors. Outputs 3 - 6 are supplied as unbalanced RCA (phono) connectors and can be used for connection of LS, RS, center and LFE channels in surround applications.
- [43] **MIC** inputs A and B are supplied as balanced XLR microphone inputs with switchable +48 V phantom power.
- [44] The **INSERT** connectors for the XLR and line inputs allow you to process input signals with outboard equipment (compressors, EQs, effects processors and so on). Additional information on using these connections is found in chapter 6.2.

4. AUDIO ROUTING

The B-CONTROL gives you a plethora of routing options that are explained in detail in this chapter. The following illustration will give you a general overview of your BCA2000's audio signal flow. You will find a detailed signal flow diagram on an extra sheet attached to this manual.

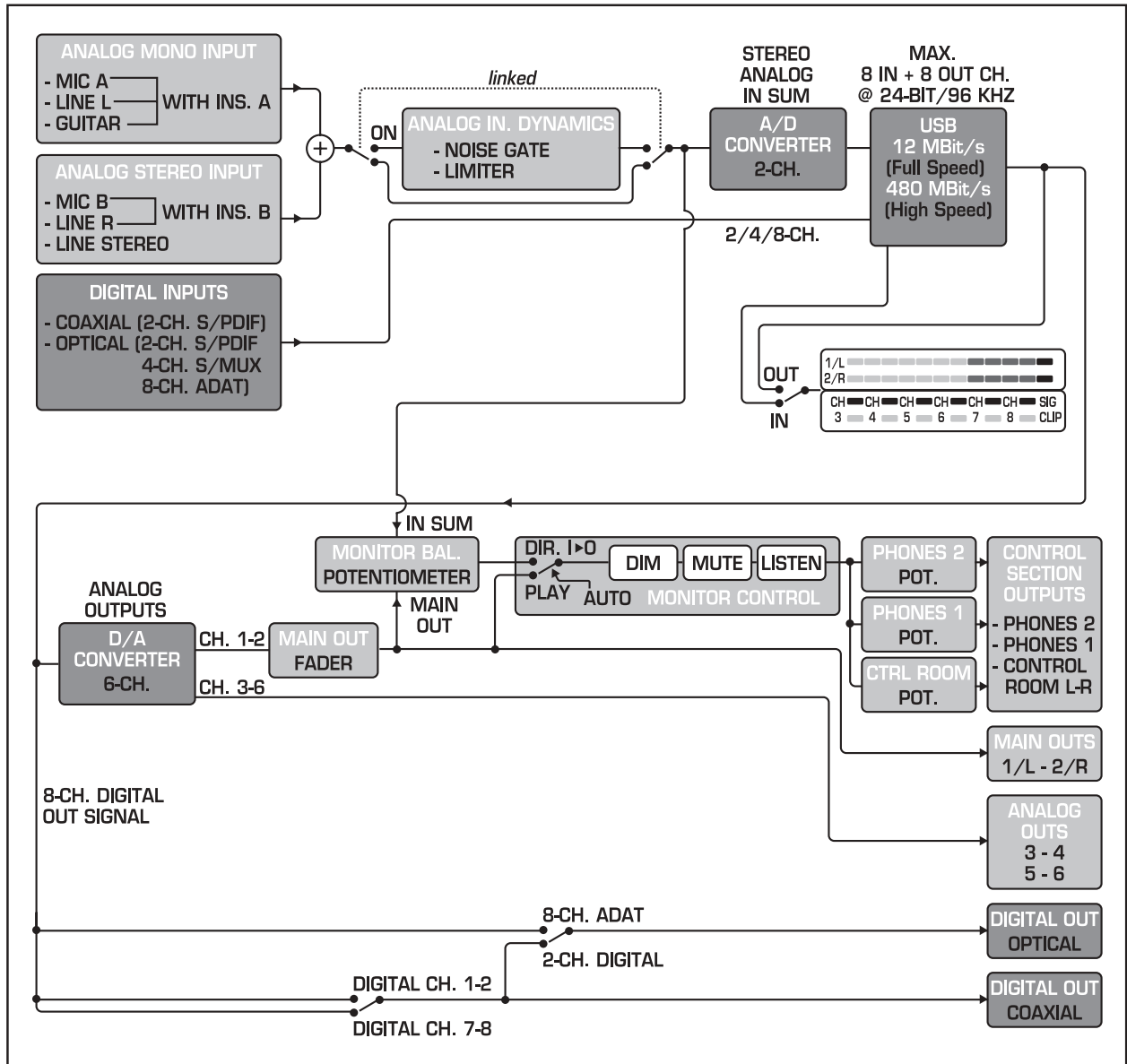


Fig. 4.1: Block diagram (overview)

4.1 Input routing

Analog inputs:

The input selectors ([6], [7], [9] and [10]) let you select the signal sources for the input channels. For the mono input channel, you can select a microphone input (MIC A), the left line input (Line L) or the front-panel high-impedance guitar input. If the GUITAR (HI-Z) button is pressed, the MIC/LINE button is deactivated; mic or line inputs can no longer be selected.

On the stereo input channel, you can select between a microphone input B (MIC B) and the right line input (Line R). The LINE STEREO button gives you yet another routing option, directing both left and right line inputs ([41]) into this channel, which then operates as a stereo channel. In this case, the mono input channel can no longer carry the left line signal. However, you can still select a microphone or guitar signal, so that a total of 3 signals (1 x mono, 1 x stereo) can be recorded simultaneously.

Mono Input	Stereo Input
GUITAR (HI-Z)	MIC B
	Line R
	Line Stereo
MIC A	MIC B
	Line R
	Line Stereo
Line L	MIC B
	Line R
	Line Stereo

Table 4.1: Analog input combination options

Insert connections are available for all mono inputs (XLR and 1/4" connectors). This insert point for external signal processors is located directly before (pre-) the B-CONTROL's internal processing and A/D converters. All selectable sources can be processed in the mono input channel, while only inputs MIC B and LINE R can be processed in the stereo input channel. If

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LINE STEREO is selected and both insert connectors are in use, only the right (LINE R) signal in the stereo input channel will be processed via insert B. Insert A works only on the mono input channel and is not affected by the position of the LINE STEREO button. +48 V phantom power is available for the microphone inputs.

The signals of both input channels are mixed together into a stereo input sum and fed into the two-channel A/D converter. Before this, the input sum signal can be processed by the internal dynamics processing section of your B-CONTROL. In this case, the signal first goes to the noise gate and then to the limiter (which effectively protects the A/D converter from clipping).

Digital inputs:

The digital inputs are available as optical and coaxial connectors. Both S/PDIF and AES/EBU formats are supported. The optical input also accepts signals in ADAT® format. Four-channel 24-bit/96 kHz operation with ADAT® S/MUX is also possible. Use the DIGITAL IN button [21] to select the digital input source. The selection is displayed in the audio routing diagram on the top of your BCA2000.

If an ADAT® or an ADAT® S/MUX signal is connected to the optical input, it is automatically recognized and activated, and the red LED in the audio routing diagram illuminates. In this case, the analog inputs are deactivated.


Combination of analog and digital inputs:

The High-Speed USB connection transmits a maximum of eight input channels. This can either be an eight-channel ADAT® signal or a combination of digital and analog input signals. Due to the BCA2000's input architecture, these are the input sum signal and a two-channel digital input signal. This signal can either come from the optical or the coaxial input, and can be selected using the DIGITAL IN switch [21]. The digital format (AES/EBU or S/PDIF) is selected in the control panel software. If an ADAT® S/MUX stream is transmitted, a maximum of four channels at 24 bit/96 kHz is available. The following table provides an overview of the possible combinations:

USB In	No ADAT® In Signal	ADAT® In Signal (44.1/48 kHz) ¹	ADAT® S/MUX In Signal (96 kHz) ¹
High-Speed Mode (480 Mbit/s)			
1	Analog In Sum L	ADAT In 1	S/MUX In 1
2	Analog In Sum R	ADAT In 2	S/MUX In 2
3	Digital In L ²	ADAT In 3	S/MUX In 3
4	Digital In R ²	ADAT In 4	S/MUX In 4
5	-	ADAT In 5	-
6	-	ADAT In 6	-
7	-	ADAT In 7	-
8	-	ADAT In 8	-
Full-Speed Mode (12 Mbit/s)			
1	Analog In Sum L	ADAT In 1	-
2	Analog In Sum R	ADAT In 2	-
3	Digital In L ²	ADAT In 3	-
4	Digital In R ²	ADAT In 4	-

1) Optical digital input must be selected. Analog In Sum (input sum) muted.
 2) Optical or coaxial digital input selectable. Format selection (AES/EBU or S/PDIF) via control panel software.

Table 4.2: Input routing

 In Full-Speed USB operation, the USB interface can only transmit 4 audio channels. Transmitting audio signals with a sampling rate of 96 kHz is not possible!

4.2 Output routing

On the output side, eight channels can also be transmitted via (High-Speed) USB. Various combinations of analog and digital outputs are available for playback.

The stereo input sum signal for USB transmission is created in the mixer of your audio software. This signal is fed digitally through the optical [37] and coaxial [38] outputs. The same signal is also available on the main analog outputs. Additionally, there are four analog RCA outputs that can be used for playing back subgroups, monitor mixes or surround signals.

Use the OPTICAL OUT button [22] to select a digital format for the optical output: ADAT or 2-CHANNEL.

4.2.1 Output routing in ADAT mode

In ADAT® mode (OPTICAL OUT button not pressed), eight channels can be played back in ADAT® format via the optical output. The eight-channel signal is also available on the analog outputs; signal/output assignments are shown in table 4.3. Use the CH. 1-2/CH. 7-8 button [23] to assign a signal source to the coaxial output: either USB channel 1-2 or 7-8. The transmission of 96-kHz signals is done per sample multiplexing via the ADAT® output.

USB Out	Analog	Coaxial	ADAT® (44.1/48 kHz)	ADAT® S/MUX (96 kHz)
High-Speed Mode (480 Mbit/s)				
1	Main Out 1/L	Digital L ¹	ADAT Out 1	S/MUX Out 1
2	Main Out 2/R	Digital R ¹	ADAT Out 2	S/MUX Out 2
3	Analog Out 3	-	ADAT Out 3	S/MUX Out 3
4	Analog Out 4	-	ADAT Out 4	S/MUX Out 4
5	Analog Out 5	-	ADAT Out 5	-
6	Analog Out 6	-	ADAT Out 6	-
7	-	Digital L ¹	ADAT Out 7	-
8	-	Digital R ¹	ADAT Out 8	-
Full-Speed Mode (12 Mbit/s)				
1	Main Out 1/L	Digital L ²	ADAT Out 1	-
	Analog Out 5		ADAT Out 5	
2	Main Out 2/R	Digital R ²	ADAT Out 2	-
	Analog Out 6		ADAT Out 6	
3	Analog Out 3	Digital L ²	ADAT Out 3	-
			ADAT Out 7	
4	Analog Out 4	Digital R ²	ADAT Out 4	-
			ADAT Out 8	

1) Switchable between USB Outs 1-2 and USB Outs 7-8 (High-Speed Mode) via button 23. Format selection (AES/EBU or S/PDIF) via control panel software.
 2) Switchable between USB Outs 1-2 and USB Outs 3-4 (Full-Speed Mode) via button 23. Format selection (AES/EBU or S/PDIF) via control panel software.

Table 4.3: Output routing in ADAT® mode

In Full-Speed USB operation, only 4 signals are transmitted per USB, and there is no support for 96 kHz operation. The digital coaxial output always carries one stereo signal selectable with the CH. 1-2/CH. 7-8 button [23]: when set to "CH. 1-2", USB channels 1 and 2 (Main Out Signal) are transmitted; when set to "CH. 7-8", USB channels 3 and 4 are transmitted. These signals are simultaneously fed to analog outputs 3 and 4. On the ADAT® output, the four USB channels are doubly occupied to transmit the eight ADAT channels (see table 4.3).

4.2.2 Output routing in 2-CHANNEL mode

In two-channel operation (OPTICAL OUT button pressed), all six analog outputs for USB channels 1 through 6 are available. Simultaneously, the digital outputs are used for two additional channels that are available at both the optical and the coaxial outputs. You can select between channels 1 and 2 (Main Out) or channels 7 and 8 via the CH. 1-2/CH. 7-8 button [23]. The transmission format in this mode can be S/PDIF, AES/EBU, DOLBY® DIGITAL or DTS®, provided the respective format is supported by the host software.

USB Out	Analog Out	Coax./Opt. Out (44.1/48 kHz)	Coax./Opt. Out (96 kHz)
High-Speed Mode (480 Mbit/s)			
1	Main Out 1/L	Digital Out L ¹	Digital Out L ¹
2	Main Out 2/R	Digital Out R ¹	Digital Out R ¹
3	Analog Out 3	-	-
4	Analog Out 4	-	-
5	Analog Out 5	-	-
6	Analog Out 6	-	-
7	-	Digital Out L ¹	Digital Out L ¹
8	-	Digital Out R ¹	Digital Out R ¹
Full-Speed Mode (12 Mbit/s)			
1	Main Out 1/L	Digital Out L ²	-
	Analog Out 5		
2	Main Out 2/R	Digital Out R ²	-
	Analog Out 6		
3	Analog Out 3	Digital Out L ²	-
4	Analog Out 4	Digital Out R ²	-
1) Sw itchable betw een USB Outs 1-2 and USB Outs 7-8 (High-Speed Mode) via button 23. Format selection (AES/EBU or S/PDIF) via control panel software. 2) Sw itchable betw een USB Outs 1-2 and USB Outs 3-4 (Full Speed Mode) via button 23. Format selection (AES/EBU or S/PDIF) via control panel software.			

Table 4.4: Output routing in two-channel mode

In **Full-Speed USB** operation, the USB outputs are not only reproduced on the main outputs but also in parallel via analog outputs 5 and 6. USB outputs 3 and 4 are routed to analog outputs 3 and 4 *and* to both digital outputs, provided the CH. 1-2/CH. 7-8 button [23] is set to "CH.7-8". When set to "CH. 1-2", output channels 1 and 2 are routed to the digital outputs. The position of this button affects both digital outputs.

4.3 First steps with the B-CONTROL

Connections (see also application examples in ch. 5):

Make sure the B-CONTROL is off before connecting it to other equipment. Connect your microphones to the XLR inputs. Amplified instruments or other line-level equipment (keyboards, CD players, external microphone preamplifiers etc.) are connected to the line inputs. If you want to record an electric guitar or other high-impedance instrument (e.g. acoustic instruments with passive pickups), connect this instrument to the HI-Z input on the B-CONTROL's front panel.

If you want to process your signal with external compressors, equalizers, de-essers or the like before recording it, connect these processors via the insert connections using commercially available insert cables (see ch. 6.2).

Use the analog main outputs to connect a mastering recorder. To stay in the digital domain during mastering, you can also connect a digital recorder via the coaxial or optical outputs. Connect your studio loudspeakers or their amplifiers to the control room outputs.

Recording:

Let's assume you want to record vocals: connect your microphone to one of the two XLR microphone inputs. If you're using a condenser microphone that requires phantom power, press the +48 V button [3]. Set the level by slowly turning the TRIM control [1] to the right while you (or your singer) speak(s) or sing(s) into the microphone. Keep an eye on the input-signal level display [2]. An incoming signal is indicated via the SIGNAL LED. The CLIP LED illuminates as soon as the input signal's level is too high and could possibly cause audible distortion. We incorporated a bit of headroom here so that the LED illuminates a few dBs before clipping/distortion. Adjust the trim control so that the CLIP LED only occasionally illuminates during the loudest passages. The input signal now has an optimal level. Use the channel fader [5] to adjust the recording volume. Be sure not to overdrive the A/D converters by carefully observing the level meter [26] and adjusting levels if necessary. Press the METER button to show the level of the input sum signal. Since the input sum signal has no level control of its own, you will have to control the master volume with both channel faders [5] when simultaneously recording several signals. Ideally, the CLIP LED should never illuminate. Keep an eye on the correct input signal level in your software. Activate the desired audio track in your software and start recording by pressing the record button.

Noise Gate:

Use the noise gate to suppress hissing and other ambient noise during signal pauses. Slowly turn the noise gate threshold control [30] clockwise until the noise has faded out; the microphone should be on but the singer should not be singing. When turned all the way to the left, the signal is not processed and the THRESHOLD LED remains dark. As soon as the threshold value exceeds the noise level and signal processing kicks in, the THRESHOLD LED illuminates. Set the threshold value very carefully so that vocal signals are not muted during fade-outs, fade-ins or quiet passages. It may be necessary to fine-tune the threshold setting with the vocalist singing (but not during the recording!).

Limiter:

The limiter serves to limit the dynamics of the input signal. You should always use the limiter if the level of the vocal varies extremely while setting levels. Adjust the limiter so that it kicks in briefly before maximum level. To this end, turn the LIMITER control [32] slowly from its "off" position (fully clockwise) counter-clockwise until the LIMIT LED begins to illuminate during the loudest signals.

Playback:

If you want to add tracks or vocals to an already recorded piece (overdub), you will want to hear the recorded tracks while overdubbing. The monitor section of the B-CONTROL offers various options for this purpose. Generally, you will be listening to the stereo sum signal of your software mixer. This signal is routed to the main output and can be adjusted using the main fader. It is also available at the headphone outputs [14] and the control room outputs [40].

DIRECT monitoring:

During a recording, you probably not only want to hear the playback, but also the sound of what you are singing or playing. In AUTO monitoring mode (MONITOR button [15] not pressed), your audio software automatically switches between input and playback signals, i.e., as soon as you start recording in your software, you can hear the input signal being recorded. When you switch to playback, you will only hear your recorded audio tracks.

In AUTO mode, system-specific latency times occur between the input signal and its playback from the computer. To avoid this, you can switch to DIRECT monitoring mode before a recording. This routes the input sum (pre-A/D converter) directly to the control room and headphone outputs for monitoring. The signal remains in the analog section of the B-CONTROL while recording, resulting in latency-free monitoring. The mix between the input signal and the playback signal from your computer can be adjusted using the MONITOR BALANCE control [19].

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ASIO Direct Monitoring:

For recording and playback purposes, the monitor signal can also be switched in the software (the BCA2000 must be in AUTO monitoring mode), provided your audio software supports ASIO Direct Monitoring. For that purpose, the following settings are available in the control panel software:

If you select **Digital**, the audio software switches the monitor outputs of your B-CONTROL between the analog input sum (record) and the main output signal (play); this depends on whether the software is in recording or playback mode.

If **Analog** is selected, the monitor balance control is active during a recording, and you can adjust the ratio between the playback and input signals. During playback only the stereo mix from the software is audible.

5. APPLICATIONS

5.1 Mobile studio

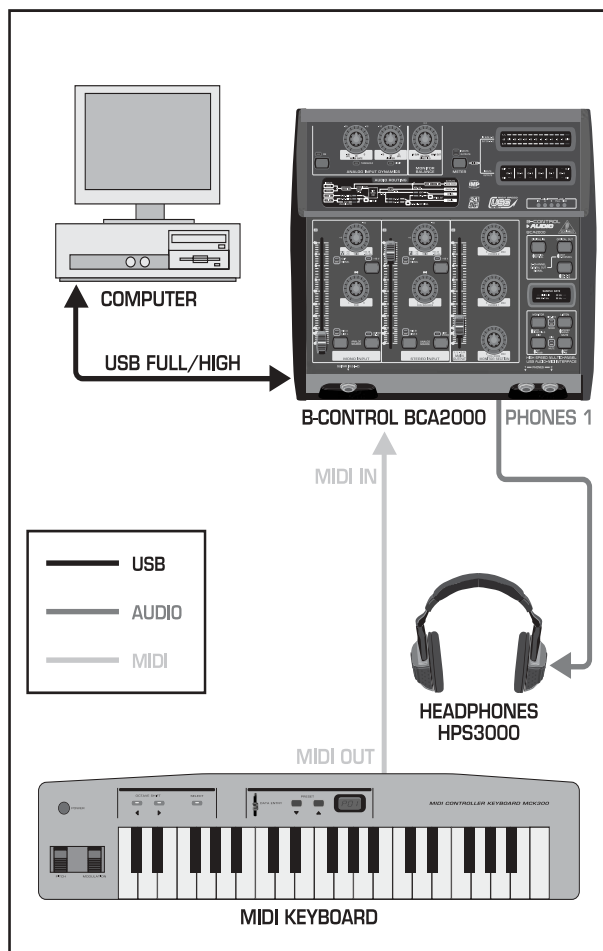


Fig. 5.1: Mobile studio

Even if you work almost exclusively with software, you still need MIDI and audio interfaces to play your software synths via a MIDI keyboard and record and listen to your music. The first example shows a small setup for a mobile studio using the BCA2000 as such an interface.

Connect the BCA2000 to a free USB port on your computer/laptop. An older Full-Speed (1.1) USB interface will suffice unless you want to work at 24-bit/96 kHz (see also 1.2.1 and 1.2.2). You can play your software instruments live and/or record MIDI tracks via the MIDI keyboard connected to the MIDI input. Monitoring is achieved via headphones connected to one of the phones outputs on the front panel of your BCA2000, while the volume is adjusted using the corresponding PHONES control. Of course,

you can connect a second set of separately adjustable headphones.

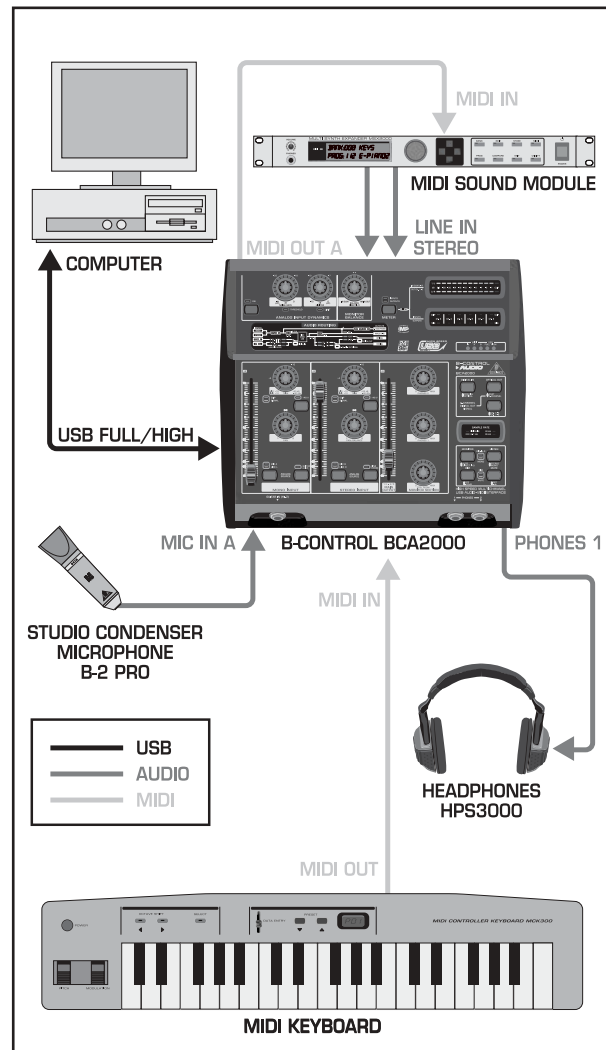


Fig. 5.2: Extended mobile studio

In this illustration, we have augmented the first example with a microphone and a MIDI expander. To record acoustic instruments or vocals in your audio software, connect your microphones directly to the XLR inputs. If you're using condenser microphones, activate the +48 V phantom power. To record an electric guitar or acoustic instrument with passive pickups, connect it to the high-impedance guitar input located on the front panel.

Use the internal noise gate and compressor in your B-CONTROL to process analog signals prior to A/D conversion. You can also connect an external processor to the INSERT connectors [44] for signal processing using your favorite outboard gear.

The MIDI sound module is controlled via MIDI output A. The sound module can be a GM/GS/XG MIDI expander, a synthesizer, a sampler, a drum machine or other MIDI sound source. The audio outputs can be routed to the software mixer via the analog stereo line inputs—or alternatively via the digital inputs, provided the sound module you are using has digital outputs.

Listening during a recording session (monitoring) can be done either digitally via the computer or latency-free using the direct monitoring function of your BCA2000. The latter is extremely helpful if the latency (computer-induced delay) is too high to allow comfortable, accurate monitoring for performing musicians/singers.

5.2 Project studio

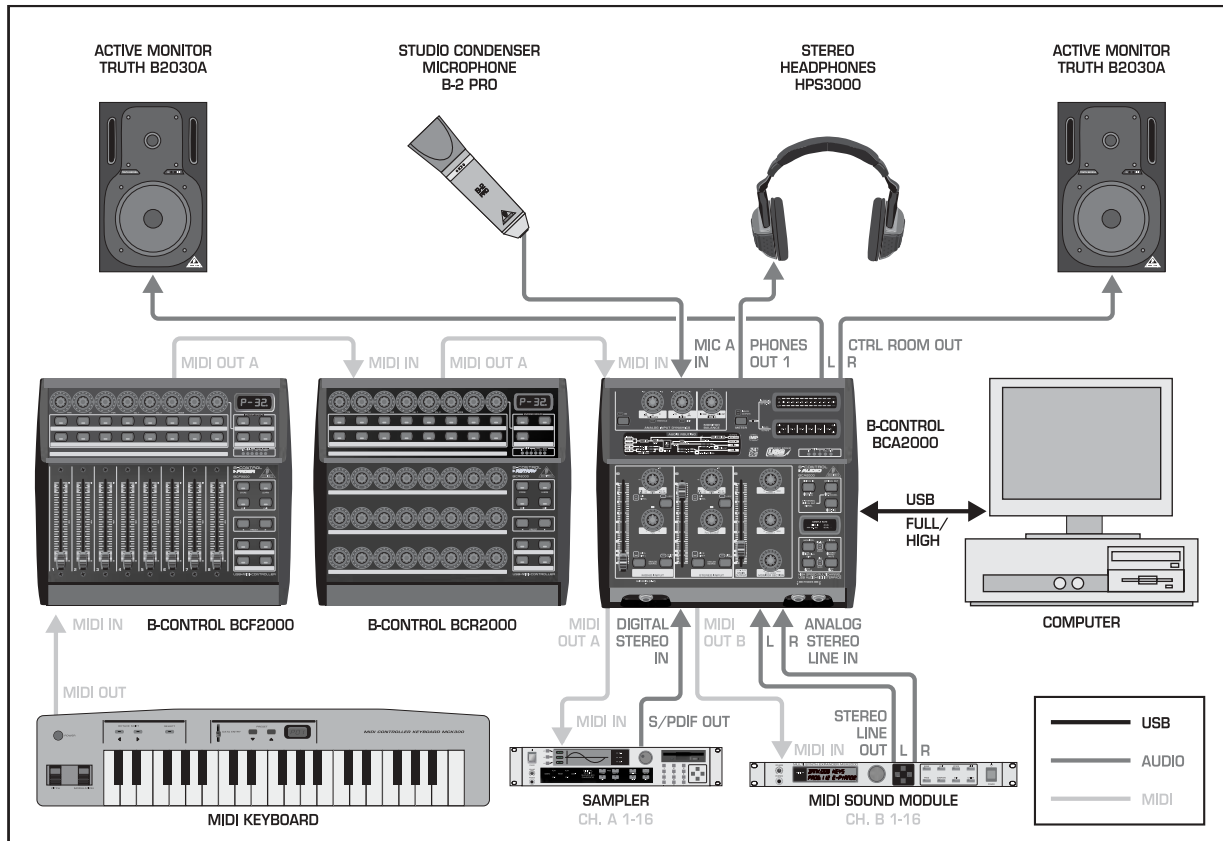


Fig. 5.3: Project studio

This application example shows the layout of a typical small project studio in which both software and hardware sound generators are used. The major difference between this and the previous examples is the greatly expanded MIDI setup. The BCA2000 acts as a central link between your studio equipment and your computer.

The illustrated MIDI connections allow the full gamut of MIDI functions to be utilized. Data from the MIDI controller and the MIDI keyboard are fed into the computer via the MIDI input. To this end, a MIDI keyboard and the two BEHRINGER MIDI controllers BCF2000 and BCR2000 are connected in series. MIDI performance data are sent to the sequencer via the keyboard. Any signal-processing plug-ins as well as the software mixer are controlled by the two MIDI controllers.

The computer communicates separately with each MIDI expander (in this case: a sound module and a sampler) via 16 MIDI channels each.

The **Audio wiring** also represents an expansion of the setup shown in fig. 5.2: the microphone and sound module signals are mixed together in stereo in the BCA2000 before they pass through the A/D converter. Additionally, an extra sound generator, stereo player, effects unit or hardware sampler (as shown in the illustration) can be fed into the computer via one of the two digital inputs on the BCA2000. This four-channel signal (A/D-converted stereo input sum + digital stereo signal) is simultaneously transmitted to the computer via USB. This setup will also work fine without a High-Speed USB connection, as long as you are satisfied with a maximum sample rate of 48 kHz.

A pair of active studio monitors was added for monitoring, connected to the control room outputs. Of course, two sets of headphones can still be connected and be controlled separately from the control room signal. You can adjust the monitor signal in several different ways (mute, dim, mono function, monitor in/out balance control etc.).

5.3 Professional studio

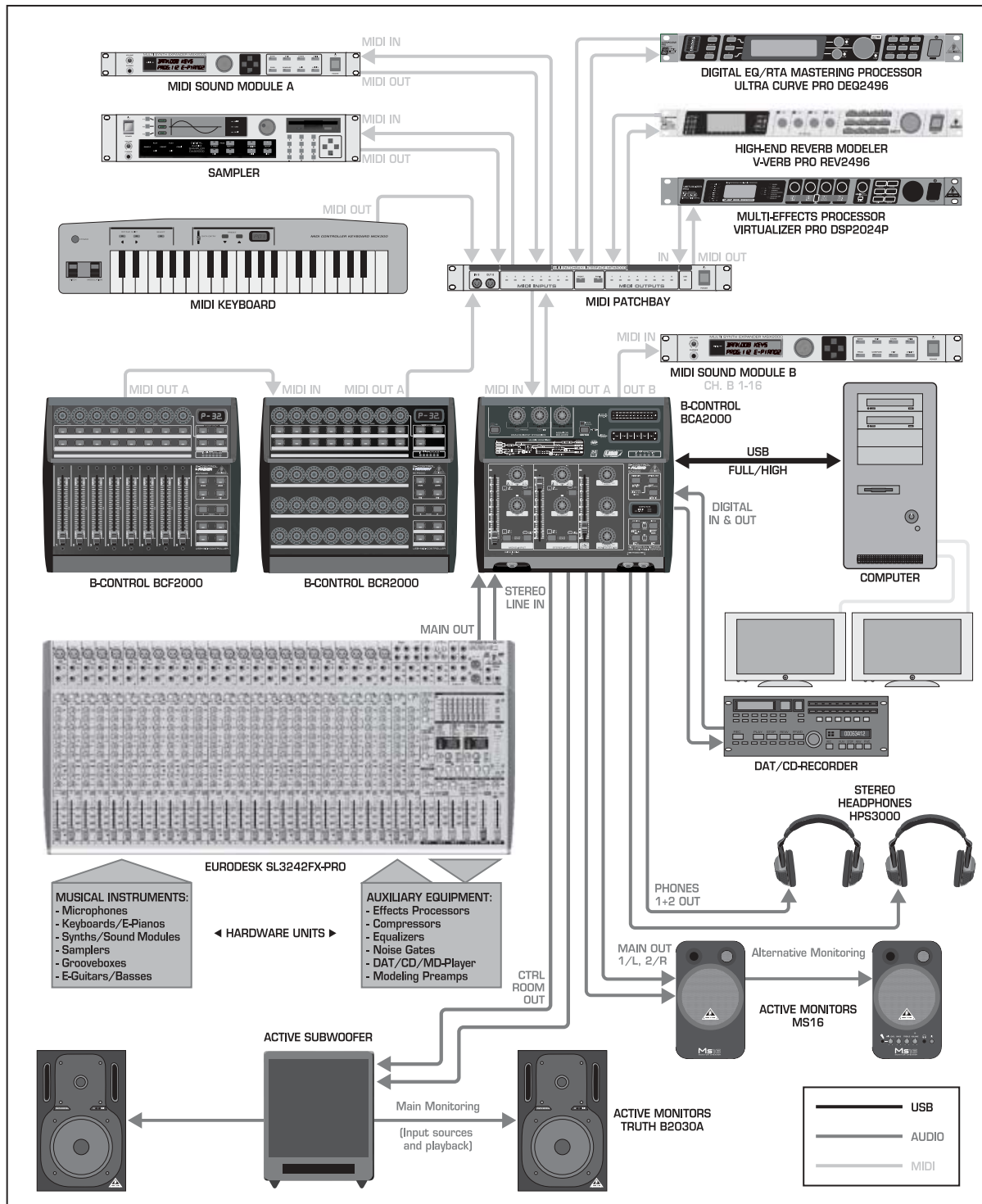


Fig. 5.4: Configuration of a professional studio

This is a professional-style studio setup with much more external equipment than in the previous examples. The MIDI network is also expanded; the entire studio's MIDI equipment is connected to a central MIDI patchbay, which in turn is connected to the BCA2000. The audio inputs are augmented via an analog mixing console that submixes all sound sources (microphones, keyboards, sound modules, samplers etc.) and feeds them into the B-CONTROL as a stereo sum signal.

The **MIDI equipment** includes a MIDI keyboard and the two BEHRINGER MIDI controllers BCF2000 and BCR2000 as input devices. Similarly, the sampler and sound module A as well all MIDI-capable effects processors (here: ULTRACURVE PRO DEQ2496, V-VERB PRO REV2496 and VIRTUALIZER PRO DSP2024P)

are all connected to the MIDI patchbay. The patchbay is connected to the BCA2000 via MIDI IN and MIDI OUT A, which in turn transmits the entire studio's MIDI data through a maximum of 16 MIDI channels to your computer. Using the second MIDI output of your BCA2000 (OUT B), you can address additional MIDI devices using up to 16 additional MIDI channels.

The **Audio wiring** follows a submixing scheme: all microphones, sound modules, effects processors and other gear such as CD players, drum computers etc. are connected to an analog mixing console (here: BEHRINGER EURODESK SL3242FX-PRO). The stereo sum signal from the mixer is fed into the line inputs of your BCA2000.

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Alternatively, you can use a **digital mixing console**, whose digital stereo sum signal is routed to the computer via the digital inputs on the B-CONTROL. If your digital console features an ADAT® optical output (like the BEHRINGER DDX3216 with the ADT1616 option), you can even transmit an eight-channel digital signal, provided your computer supports High-Speed USB.

In our example with an analog mixer, a DAT or a CD recorder is connected to the digital connectors. Along with the analog stereo sum signal from the console, four parallel input channels are transferred to the computer.

The **Monitoring options** are also considerably expanded in this setup; all options can be used simultaneously. A pair of BEHRINGER TRUTH B2030A active monitors with an additional

active subwoofer are used here as main monitors. The control room outputs are connected to the subwoofer; from there the signal is passed on to the TRUTH loudspeakers.

The same signal is also available via two sets of headphones (e.g. for musicians), whereby their volume can be adjusted separately.

An additional pair of monitor speakers is connected to the main outputs. The new BEHRINGER MS16 speakers that simulate the listening experience of using smaller monitors are shown here. Their volume is adjusted using the main fader. With such flexible control options, you can better judge the various criteria of your mix in order to produce sonically accurate mixes that translate well to various systems.

5.4 Basis recording session

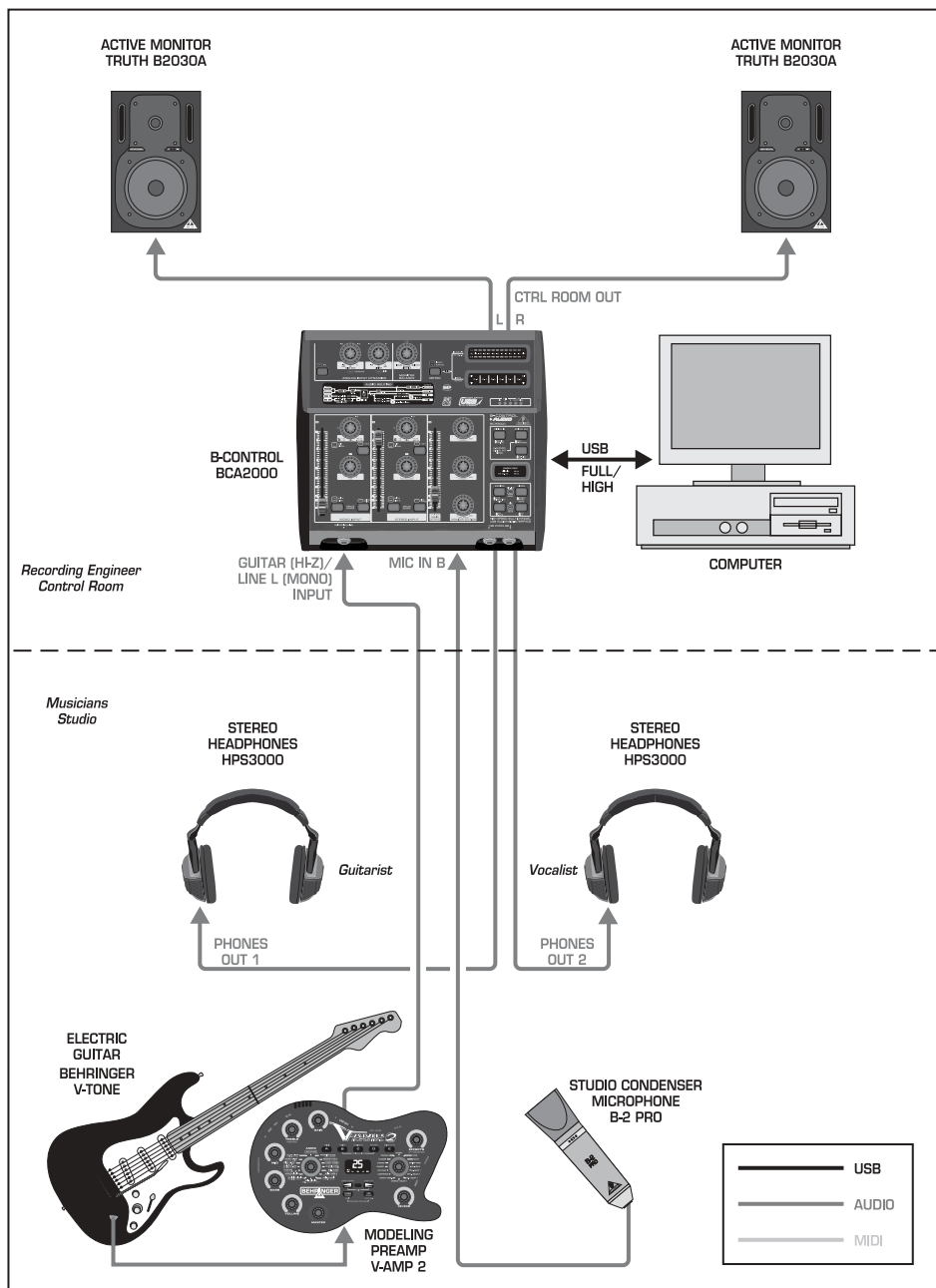


Fig. 5.5: Basis recording session

This recording setup is easily transportable, for example, to a recording session at a friend's or fellow musician's apartment. All you need is a laptop computer, the BCA2000, two to three headphones and/or a couple of active loudspeakers—plus of course microphones and instruments as required.

There are several options for recording a guitar: you can either connect the guitar to the front-panel guitar input and process the signal with the BCA2000's dynamics section and/or your computer's plug-ins or, as shown in the illustration on the previous page, connect your guitar to a preamp (e.g. BEHRINGER V-AMP 2) and the preamp to the BCA2000's line input.

Connect a vocal microphone to the MIC B input. You can also record an acoustic guitar or other acoustic instruments together with the vocals. In this case, use two microphones: one for the instruments and the other one for the vocals.

If you are using loudspeakers for monitoring, the sound engineer—armed with a laptop, the monitors and the BCA2000—should be located in a separate room isolated from the musicians, in order to properly judge the recording without hearing the original sound, and to prevent feedback and ambient noise problems. If the engineer uses a third set of headphones instead of the monitors, everyone can be in the same room (although the engineer will have to be very quiet!). In this case, the two sets of headphones for the musicians can be connected to one PHONES output using a Y-cable or adapter. The sound engineer's headphones are then connected to the other PHONES connector.

5.5 Multi-channel recording with 5.1 surround monitoring

Illustration 5.6 shows how to do a multi-channel recording of a live performance and monitor it in 5.1 surround sound. Theoretically, you can record an entire orchestra, big band, choir or a play with a maximum of eight channels and monitor your recording in 5.1 surround.

Recording: In our example, an orchestral performance is being recorded. Six microphones are being used: 5 studio condenser microphones and a so-called boundary microphone, which is placed on the floor close to the orchestra. Of course, you can also use other microphones and positioning as your experience and/or preferences dictate.

Two microphones are used as main stereo mics (L/R), while a third, emphasizing the center signal, is placed near the conductor. Two additional microphones (facing the audience) record the surround sound (surround left and surround right), while the boundary microphone in the orchestra supports the low frequencies for the LFE or sub-bass channel.

All microphone signals pass through a multi-channel mic preamp and are converted into digital signals. The BEHRINGER ULTRAGAIN PRO-8 DIGITAL ADA8000, shown here, generates an eight-track ADAT® signal that is routed to the BCA2000 through the optical output. From there on, it is passed on to the computer via High-Speed USB.

Mix: To mix the live recording, hardware control elements to control the software mixer can be very useful. In this illustration, two BCF2000 MIDI controllers are used; connected to the BCA2000 via MIDI, they control the software mixer during recording/playback.

Monitoring/playback: All loudspeakers necessary for 5.1 surround monitoring can be connected directly to the BCA2000's analog outputs. Here, 5 active monitor loudspeakers (shown: BEHRINGER TRUTH B2030A) and a subwoofer for the LFE channel are used. You can also connect two additional loudspeakers to the control room outputs, with which you can monitor the main stereo signal. The main stereo signal is also fed to both headphone outputs, allowing conductors, technical assistants or sound engineers to monitor via headphones.

The loudspeaker setup shown here can also be used to listen to the sound track from a DVD playing on your computer in surround sound, provided your software features a DOLBY® DIGITAL or DTS® decoder.

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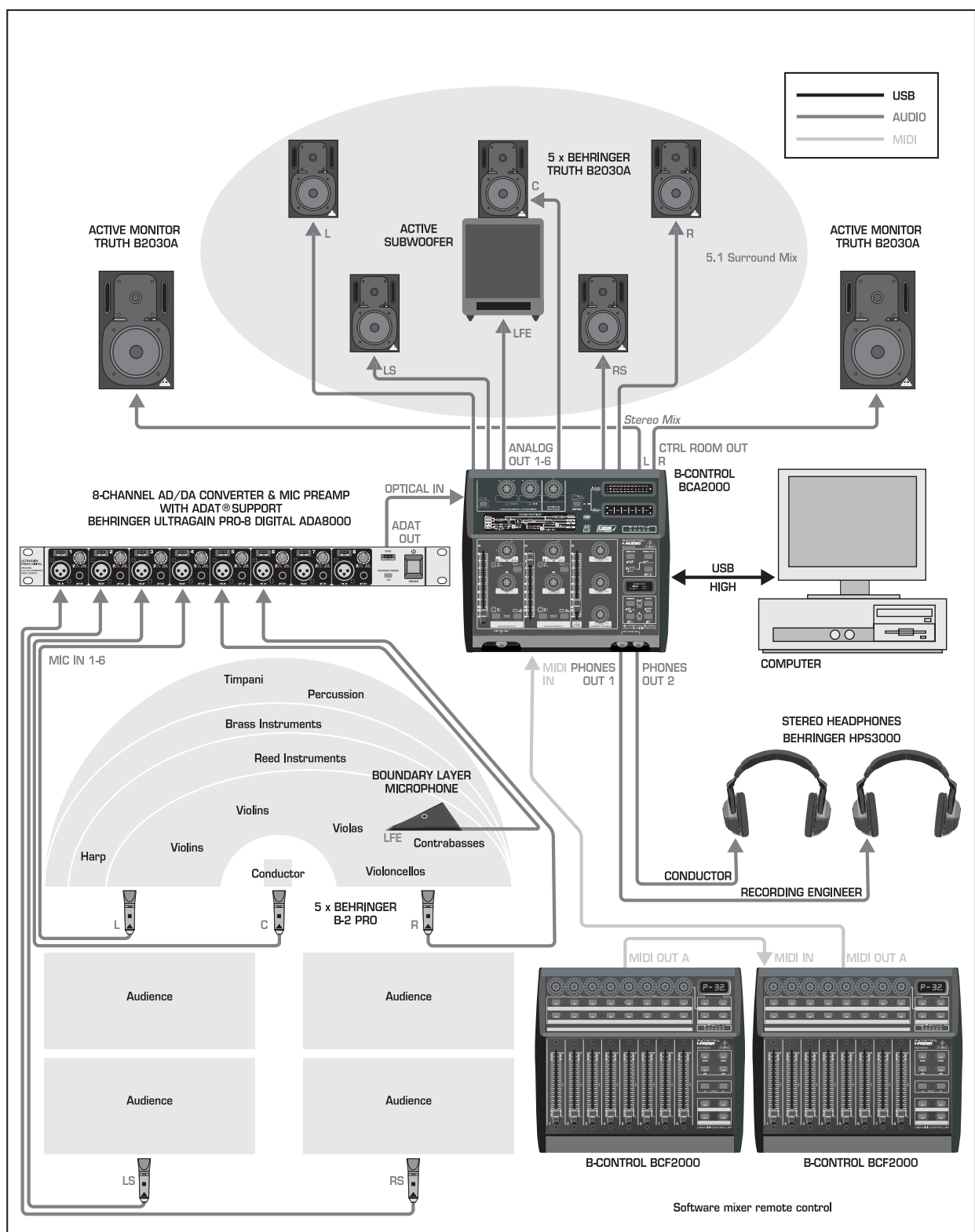


Fig. 5.6: Multi-channel recording with 5.1 surround monitoring

6. CONNECTIONS AND FORMATS

6.1 Glossary

Some technical terminology and acronyms that you may encounter while working with the BCA2000 are explained in this glossary. Explanations of additional terminology can be found in our online glossary at www.behringer.com. You can find more information about surround sound in the surround manual of our digital mixing console DDX3216, which can be downloaded from our website free of charge at www.behringer.com.

AC-3

More widely known as → *DOLBY® DIGITAL*, AC-3 is the most popular surround format today. Six separate digital sound channels are data-compressed, encoded and → *decoded* (front left, front right, front middle/center, rear left, rear right and sub-bass channel, called → *LFE*).

The BCA2000 can reproduce this data format through the digital outputs, provided your audio software contains a *DOLBY® DIGITAL* → *decoder*. This can be an audio application that uses a software decoder as a → *Plug-In* or a DVD disc that is reproduced on your computer's DVD drive.

The six-channel music signal is then AC-3-encoded (→ *Encoder*), connected to a surround receiver with a digital input (or similar) via one of the digital outputs and decoded internally by the receiver's AC-3 → *Decoder*, and then reproduced on the six analog speaker outputs.

ADAT®

The eight-channel digital audio format ADAT® owes its name to the first 8-track digital recorder from Alesis. The ADAT® format has established itself as the multi-channel standard of choice, generally supporting 44.1 and 48 kHz → *Sample Rates*. 88.2 and 96 kHz sample rates are also possible, but only with four (instead of eight) digitally transmitted channels. This version is called → *S/MUX*.

Just a single optical cable (very thin optical fiber) is required to transmit all eight (or four) channels of an ADAT® signal between two different units using the optical input and output connectors. These connectors are sometimes called → *TOSLINK*.

The BCA2000 supports both the standard ADAT® format with 8 channels (at 44.1 or 48 kHz sampling rate) and the *S/MUX* format with 4 channels (at 96 kHz sampling rate), both on the inputs and the outputs via the optical in/out connectors.

A/D converter

An A/D converter transforms an analog audio signal into a digital signal, for example to enable recording on digital recorders such as CD/DAT/MD recorders or for recording and/or additional processing in a computer.

All equipment utilizing digital technology that features standard analog connectors (i.e. 1/4" or XLR) has an internal A/D → *D/A Converter*. These can be synthesizers, digital mixing consoles, almost all standard delay or multi-effects units or sound cards.

The quality of the converter is often expressed as a combination of its bit rate and its sampling frequency (e.g. 24-bit/96 kHz). Generally speaking, the higher these two values, the better the resolution and therefore the better the audio quality. Older CD players operate at 16-bit/44.1 kHz. The BCA2000 supports the current DVD quality standard of 24-bit/96 kHz.

AES/EBU

This professional digital stereo audio format gets its acronym from the Audio Engineering Society and European Broadcasting Union. Unlike the consumer format → *S/PDIF*, AES/EBU signals are usually transmitted using balanced cables with XLR connectors, enabling extremely long cable runs without signal degradation or additional noise. See also → *S/PDIF*.

Clock

Many digital devices feature → *Sync*, Clock or Wordclock connections, usually in the form of coaxial BNC connectors. When using two or more interconnected digital devices simultaneously, they must be synchronized to the same clock to ensure sample rate timing coherence. This synchronization is performed via the wordclock connector or the digital inputs, i.e. through the digital audio signal.

Coder/Coding

Synonymous to → *Encoder/Encoding*.

D/A converter

A D/A converter converts digital audio signals into analog audio signals. See also → *A/D Converter*.

Decoder/Decoding

Decoding refers to "deciphering" a digital signal. If you wish to transmit or store a digital signal in compressed form (condense/reduce data quantity), you will have to → *encode* it. To use this signal later or at a different location, you will have to first decode the signal. These processes generally occur automatically in digital audio devices/applications.

DOLBY® DIGITAL

A more popular name for the → *AC-3* surround format.

DTS®

The "Digital Theater Sound System" is similar in function to the 6-channel surround format → *DOLBY® DIGITAL* (→ *AC-3*). Because DTS® utilizes more moderate compression (data reduction), it sounds somewhat better than AC-3 but requires more storage space, e.g. on a DVD. This format is also supported by the BCA2000 on its digital outputs.

Encoder/Encoding

Encoding refers to "encrypting" a digital signal using an encoder. See → *Decoder/Decoding*.

Interface

General term referring to connection standards used for digital data transfer.

The → *MIDI* interface enables communication between digital devices; a device with a MIDI interface generally has three MIDI connectors: MIDI In, Out and Thru. The BCA2000 has all three.

"Audio interface" generally refers to both internal and external computer sound cards. Internal are those that are built into the computer (usually PCI cards). External sound cards or audio interfaces are those that are usually connected to the computer via → *USB* or *IEE1394* (also known as *FireWire®*), such as the BCA2000.

LFE

LFE (Low Frequency Effect; sometimes called Low Frequency Enhanced) refers to the → *Subwoofer* or sub-bass channel that reproduces the lowest frequencies of the surround soundtrack (generally below 80 Hz). This ultra low-frequency information is usually experienced as sound pressure rather than as identifiable audio, especially in movie theaters. Even when the *LFE*-subwoofer is located front and center, the signal is hard to locate spatially, since frequencies this low are difficult for the human ear to process precisely—so instead of actually "hearing" them, you "feel" them. The ".1" in the nomenclature of various surround formats, such as 5.1, 6.1 and 7.1, refers to the *LFE* channel. See also → *Surround*.

Limiter

A limiter limits the dynamic spectrum of signal peaks. The maximal volume of a signal is defined by the → *Threshold* value.

Limiters are often used to avoid overdriving → *A/D Converters*, because this can cause digital distortion, which—unlike slight analog distortion—is extremely unpleasant, clearly audible and never desirable. The BCA2000 features an adjustable limiter for the input sum directly pre- (before) → *A/D Converters*.

MIDI

The Musical Instruments Digital Interface is a generic, non-manufacturer-specific standard that enables communication between electronic music instruments. If you connect the MIDI Out (output) of the first device to the MIDI In (input) of the second device, the second device can be "remotely controlled" by the first device. If device 1 is a MIDI keyboard and device 2 a keyless tone generator ("MIDI expander", sound module or similar), you can "play" device 2 from your MIDI keyboard, implement program changes or influence various sound parameters in real time.

Important! MIDI merely "controls" devices; absolutely no audio data is transmitted! The above example will actually let you hear the MIDI expander controlled by the MIDI keyboard only if the audio outputs of your MIDI expander are also connected to a mixing console and/or amplifier and loudspeakers, or if headphones are connected to the expander's headphone output.

Noise Gate

A noise gate suppresses noise and interference during signal pauses by muting the signal path when the input signal falls below a predetermined → *Threshold* value. A noise gate is generally used to eliminate noise and crosstalk. Also known as gate, suppressor or noise suppressor, while the terms expander and downward expander refer to the type of circuitry or method of suppression used.

The BCA2000 features a noise gate for the analog input sum, located directly pre- → *Limiters* and pre- → *A/D-Converters*.

Phono

Also known as RCA, these unbalanced connections for analog audio are primarily found in hi-fi applications but are also commonly used for the digital S/PDIF interface. The BCA2000 features both, and they are labeled correspondingly.

Plug-In

A plug-in is an addition to a full-fledged computer program; these additions "embed" themselves into the main application and augment its functionality. Plug-ins are not stand-alone programs; they always need a "host" application to work.

Some of the more well-known plug-in formats in computer audio technology are Direct X and VST interfaces. If an audio application supports, for example, the VST format, additional effects or virtual tone generators can be integrated into the main program and be controlled, adjusted, played and recorded within the host application.

RCA

Another term for → *Phono* connectors.

Sample Rate

The sample rate is often considered an important quality criterion for certain audio standards or → *A/D converters*. For example, CDs use a sample rate of 44.1 kHz. This means that an audio signal is digitally sampled 44,100 times per second. With the → *ADAT*® format, 48 kHz is common, and with DVDs, 96 kHz is the norm.

The BCA2000 supports all of these standard sample rates. If you wish to produce a CD, it is recommended to select 44.1 kHz for the entire production (all digital devices and all tracks in the audio software). This will prevent possible quality loss due to subsequent sample rate conversions.

With → *A/D converters*, the sample rate needs to be roughly twice the frequency of the audio signal that is being digitalized. This means: With a sample rate of 44.1 Hz, the highest audio frequency that is accurately reproduced is about 22,000 Hz. This frequency lies above the highest frequency audible by a healthy human ear.

Sampling frequency

See → *Sample Rate*

S/MUX

S/MUX (Sample Multiplexing) is a special → *ADAT*® format that supports a → *Sample Rate* of 96 kHz, with the limitation that only 4 audio channels can be transmitted instead of the usual 8. See

also → *ADAT*®. The BCA2000 supports this format as well as the standard → *ADAT*® format on the optical digital inputs and outputs.

S/PDIF

The Sony/Philips Digital Interface Format is a consumer standard for transmitting digital audio. This unbalanced interface utilizes → *RCA* or optical → *TOSLINK* connections.

From the point of view of data structure, this signal is very similar to the professional → *AES/EBU* format. Therefore, you can transmit AES/EBU and S/PDIF signals using the same cables and connectors, although AES/EBU is generally transmitted via XLR connectors and balanced cables, enabling extremely long cable runs without signal degradation or interference. S/PDIF is usually used for data transmission over shorter distances with unbalanced cables.

The BCA2000 features both RCA and optical connectors; the control panel software provided with the unit allows you to select either the AES/EBU or the S/PDIF format.

Subwoofer

Large bass loudspeaker designed to produce extremely low frequencies (generally between 20 and 150 Hz), which cannot be spatially located by the human ear and are thus usually experienced as sound pressure rather than distinguishable audio signals. For this reason, subwoofers are often used in mono. Subwoofers are commonly used in large P.A. systems (concerts etc.) as well as in movie theaters etc.; also used in home → *Surround* systems. See also → *LFE*.

Surround

Since the introduction of DVD video, surround sound (three-dimensional room sound) has continuously gained in popularity and importance. Surround audio formats have been around since the 1970s, for example the failed attempt at launching quadraphonic sound, or the Dolby® Surround format that was introduced in the movie 'Star Wars' in 1978. Nowadays, → *AC-3* (→ *DOLBY*® *DIGITAL*) and → *DTS*® have established themselves as the prevalent standards. In this context, the 5.1 format is generally considered to be the standard: 5 full-range loudspeakers plus one → *Subwoofer*. The 5 loudspeakers are divided into Left Front (generally called 'L'), Right Front ('R'), Center ('C', mostly for dialog) as well as Left Rear or Left Surround, ('LS') and Right Rear or Right Surround, ('RS').

The BCA2000 can play back all common surround formats via its digital outputs, provided that correspondingly encoded signals are available on your computer.

Sync

Abbreviation for "Synchronization". Connectors labeled "Sync" often have the same function as → *Clock* or *Wordclock*.

Threshold

The level above or under which a signal processor becomes active, i.e. a compressor, → *Limiters* or → *Noise Gate*.

TOSLINK

Term describing the optical (consumer) connector used for transmission of digital audio signals such as → *S/PDIF* or → *ADAT*®. A fiber-optic cable transmits the data between two TOSLINK connectors. The BCA2000 has one TOSLINK or optical input and output connector each.

USB

The Universal Serial Bus is the current standard for connecting peripheral devices such as scanners, printers or audio → *Interfaces* to a computer.

USB 1.1:

Until recently, there was only the so-called USB 1.1 standard, whose maximal data transmission rate was 12 Mbps (megabits per second). This places certain restrictions on audio applications. For example, a maximum of eight signals can be transmitted simultaneously with a maximum resolution of 24 bits and 48 kHz → *Sample Rate*: two inputs and six outputs or four inputs and four outputs. At 24 bit/96 kHz only stereo recording/playback is possible. An eight-channel transmission in one direction (to or from a computer) would also be problematic.

B-CONTROL ► AUDIO BCA2000

USB 2.0:

These issues were resolved with the next USB standard, USB 2.0, due to a data transmission speed of 480 Mbps. This new standard is every bit as powerful as the FireWire® or IEEE1394 interface, and enables the simultaneous transmission of more than 16 audio channels to and from a computer with full 24-bit/96 kHz support.

Full-Speed USB & High-Speed USB:

Unfortunately, several manufacturers have begun referring to both the older, slower USB 1.1 interface and the newer, much faster USB 2.0 as USB 2.0. This causes a great deal of confusion and often misleading. A printer, for example, that claims to have a USB 2.0 interface, will not necessarily be able to process data at 480 Mbps.

The new official distinction between the two standards is defined as follows:

- 1) Full-Speed USB (the "old" USB 1.1) with 12 Mbps and 2) High-Speed USB (introduced as USB 2.0) with 480 Mbps.

The suffixes "1.1" and most notably "2.0" should preferably not be used anymore, since—due to misuse—they only cause confusion and provide no real information about the interface's data transmission rate.

The BCA2000 supports both USB formats, Full-Speed and High-Speed, and automatically detects which format your computer uses, indicating this value both on the appropriate LEDs on the BCA2000 and in the control panel software.

Wordclock

See → *Clock* and → *Sync*.

6.2 Audio connections

You will need many different types of cables for various applications. The following illustrations show how these cables should be wired. Please always use high-quality cables.

The B-CONTROL's analog audio inputs are electronically balanced to avoid hum problems.

Of course, you can also connect unbalanced equipment to the balanced inputs/outputs of your BCA2000: either use mono plugs or bridge the ring to the sleeve on TRS connectors (on XLR connectors, bridge pin 1 to pin 3).

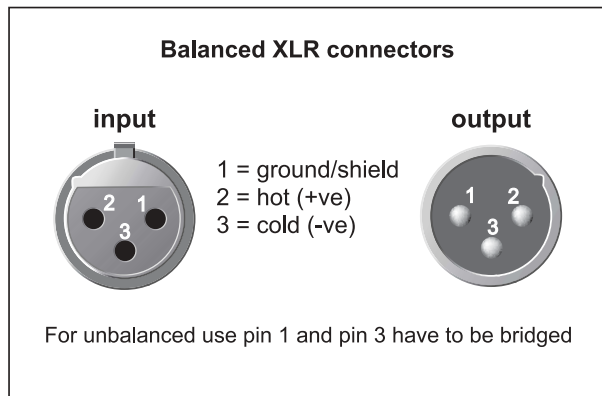


Fig. 6.1: XLR connections

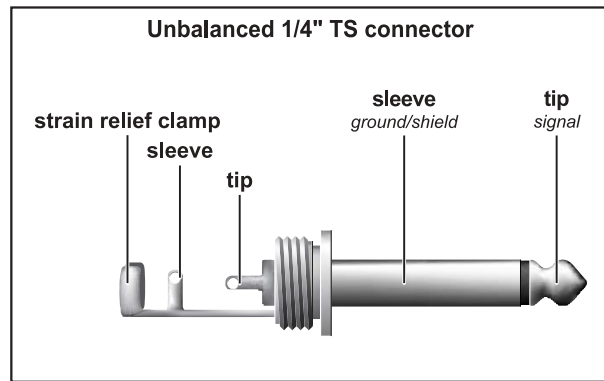


Fig. 6.2: 1/4" TS connector

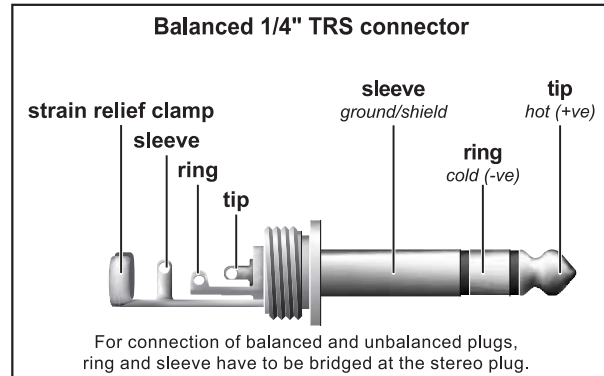


Fig. 6.3: 1/4" TRS connector

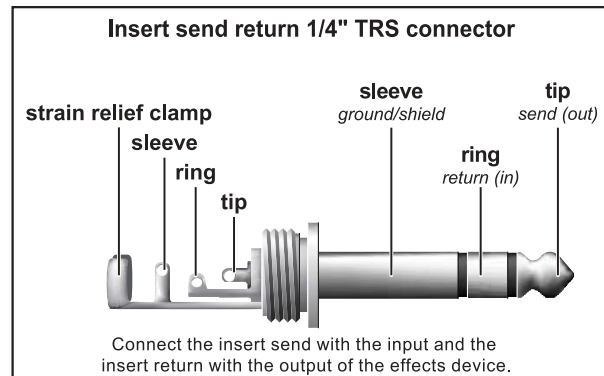


Fig. 6.4: 1/4" TRS connector for insert cables

6.3 Digital inputs and outputs

The B-CONTROL features coaxial and optical digital interfaces that allow two-channel transmission of signals with a resolution of up to 24 bits. The sample rate is not fixed and can be freely selected in your host application. Sample rates of 44.1, 48 and 96 kHz are typical. Both interfaces support AES/EBU and S/PDIF formats. Additionally, the optical interface (TOSLINK) enables four-channel transmission in the ADAT® S/MUX format (at 96 kHz) as well as the standard eight-channel ADAT® format (at 44.1 or 48 kHz). The DOLBY® DIGITAL and DTS® formats are also supported on the outputs (both optical and coaxial), provided your computer software (e.g. software DVD player) reproduces the respective format.

6.4 MIDI connectors

The MIDI connectors on the rear panel feature the internationally standard 5-pin DIN connectors. To connect the B-CONTROL to other MIDI devices, you need a MIDI cable. In general, commercially available cables can and should be used. Their length should not exceed 5 m (15 ft.).

MIDI IN: This connector is used for receiving MIDI data.

MIDI OUT A/B: Data for controlling other MIDI equipment can be sent through the MIDI outputs.

MIDI THRU: MIDI OUT B can be configured as MIDI THRU in the control panel software, allowing any data received via the MIDI IN to be passed on without being modified.

7. SPECIFICATIONS

AUDIO INPUTS

Microphone inputs (IMP Invisible Mic Preamp)

Type	XLR balanced
Gain range	+10 to +60 dB
Frequency response	10 Hz - 200 kHz (-3 dB)
Impedance	approx. 2.2 kΩ (balanced)
Max. input level	+10 dBu (@ +10 dB Gain)
Signal-to-noise ratio	108 dB (112 dB A-weighted)
Distortion (THD+N)	0.005 % (0.004 % A-weighted)

Line inputs (2)

Type	1/4" TRS connector, balanced
Gain range	-10 to +40 dBu
Impedance	approx. 20 kΩ (balanced)
Max. input level	+26 dBu (@ 0 dB Gain)

Guitar input (1)

Type	1/4" TS connector
Gain range	-10 to +40 dBu
Impedance	approx. 1 MΩ
Max. input level	+20 dBu (@ 0 dB Gain)

AUDIO OUTPUTS

Control Room L/R

Type	1/4" TRS stereo
Impedance	approx. 120 Ω
Signal-to-noise ratio	115 dB
Crosstalk	-80 dB @ 1 kHz
Max. output level	+20 dBu

Main Out

Type	(Main 1/2, Cinch 3-6)
Impedance	approx. 120 Ω
signal-to-noise ratio	100 dB
Crosstalk	< -80 dBu @ 1 kHz
Max. output level	+20 dBu

Headphones outputs (2)

Type	1/4" TRS connector with separate volume controls
Max. output level	+20 dBu

INSERTS (2)

Type	1/4" TRS connector, unbalanced
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DYNAMIC SECTION

Noise Gate Threshold	-∞ to 0 dB
Limiter Threshold	-15 to 0 dB

DIGITAL INPUTS

Type	Cinch coaxial
Standard	AES/EBU, S/PDIF
Input impedance	75 Ω
Nom. input signal level	0.2 - 5 V peak-to-peak

Type	TOSLINK optical
Standard	AES/EBU, S/PDIF, ADAT®, S/MUX

DIGITAL OUTPUTS

Type	Cinch coaxial
Standard	AES/EBU, S/PDIF, AC-3/DTS®
Impedance	75 Ω
Output signal level	2.5 V peak-to-peak

Type	TOSLINK optical
Standard	AES/EBU or S/PDIF, AC-3/DTS®, ADAT®, S/MUX

DIGITAL PROCESSING

Converter	24 Bit/96 kHz
Sample rate	44.1 kHz, 48 kHz, 96 kHz
Signal-to-noise ratio	A/D: 100 dB typ. D/A: 102 dB

USB INTERFACE

Type	High-Speed 480 MBit/s Full-Speed 12 MBit/s
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MIDI INTERFACE

Type	5-pin DIN connectors: IN, OUT A, OUT B/THRU
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POWER SUPPLY

Voltage	85 - 250 V~, 50 - 60 Hz
Power consumption	max. 10 W
Fuse	T 1 A H 250 V
Mains connection	Standard IEC receptacle

DIMENSIONS/WEIGHT

Dimensions (H x W x D)	13" x 4" x 11 4/5" (330 mm x 100 mm x 300 mm)
Weight	approx. 5 lbs (2.25 kg)

BEHRINGER is constantly striving to maintain the highest professional standards. As a result of these efforts, modifications may be made from time to time to existing products without prior notice. Specifications and appearance may differ from those listed or illustrated.

8. WARRANTY

§ 1 WARRANTY CARD/ONLINE REGISTRATION

To be protected by the extended warranty, the buyer must complete and return the enclosed warranty card within 14 days of the date of purchase to BEHRINGER Spezielle Studiotechnik GmbH, in accordance with the conditions stipulated in § 3. Failure to return the card in due time (date as per postmark) will void any extended warranty claims. Based on the conditions herein, the buyer may also choose to use the online registration option via the Internet (www.behringer.com or www.behringer.de).

§ 2 WARRANTY

1. BEHRINGER (BEHRINGER Spezielle Studiotechnik GmbH including all BEHRINGER subsidiaries listed on the enclosed page, except BEHRINGER Japan) warrants the mechanical and electronic components of this product to be free of defects in material and workmanship for a period of one (1) year* from the original date of purchase, in accordance with the warranty regulations described below. If the product shows any defects within the specified warranty period that are not excluded from this warranty as described under § 4, BEHRINGER shall, at its discretion, either replace or repair the product using suitable new or reconditioned parts. In the case that other parts are used which constitute an improvement, BEHRINGER may, at its discretion, charge the customer for the additional cost of these parts.

2. If the warranty claim proves to be justified, the product will be returned to the user freight prepaid.

3. Warranty claims other than those indicated above are expressly excluded.

§ 3 RETURN AUTHORIZATION NUMBER

1. To obtain warranty service, the buyer (or his authorized dealer) must call BEHRINGER (see enclosed list) during normal business hours **BEFORE** returning the product. All inquiries must be accompanied by a description of the problem. BEHRINGER will then issue a return authorization number.

2. Subsequently, the product must be returned in its original shipping carton, together with the return authorization number to the address indicated by BEHRINGER.

3. Shipments without freight prepaid will not be accepted.

§ 4 WARRANTY REGULATIONS

1. Warranty services will be furnished only if the product is accompanied by a copy of the original retail dealer's invoice. Any product deemed eligible for repair or replacement under the terms of this warranty will be repaired or replaced.

2. If the product needs to be modified or adapted in order to comply with applicable technical or safety standards on a national or local level, in any country which is not the country for which the product was originally developed and manufactured, this modification/adaptation shall not be considered a defect in materials or workmanship. The warranty does not cover any such modification/adaptation, irrespective of whether it was carried out properly or not. Under the terms of this warranty, BEHRINGER shall not be held responsible for any cost resulting from such a modification/adaptation.

3. Free inspections and maintenance/repair work are expressly excluded from this warranty, in particular, if caused by improper handling of the product by the user. This also applies to defects caused by normal wear and tear, in particular, of faders, crossfaders, potentiometers, keys/buttons, tubes, guitar strings, illuminants and similar parts.

4. Damages/defects caused by the following conditions are not covered by this warranty:

▲ improper handling, neglect or failure to operate the unit in compliance with the instructions given in BEHRINGER user or service manuals.

▲ connection or operation of the unit in any way that does not comply with the technical or safety regulations applicable in the country where the product is used.

▲ damages/defects caused by force majeure or any other condition that is beyond the control of BEHRINGER.

5. Any repair or opening of the unit carried out by unauthorized personnel (user included) will void the warranty.

6. If an inspection of the product by BEHRINGER shows that the defect in question is not covered by the warranty, the inspection costs are payable by the customer.

7. Products which do not meet the terms of this warranty will be repaired exclusively at the buyer's expense. BEHRINGER will inform the buyer of any such circumstance. If the buyer fails to submit a written repair order within 6 weeks after notification, BEHRINGER will return the unit C.O.D. with a separate invoice for freight and packing. Such costs will also be invoiced separately when the buyer has sent in a written repair order.

§ 5 WARRANTY TRANSFERABILITY

This warranty is extended exclusively to the original buyer (customer of retail dealer) and is not transferable to anyone who may subsequently purchase this product. No other person (retail dealer, etc.) shall be entitled to give any warranty promise on behalf of BEHRINGER.

§ 6 CLAIM FOR DAMAGES

Failure of BEHRINGER to provide proper warranty service shall not entitle the buyer to claim (consequential) damages. In no event shall the liability of BEHRINGER exceed the invoiced value of the product.

§ 7 OTHER WARRANTY RIGHTS AND NATIONAL LAW

1. This warranty does not exclude or limit the buyer's statutory rights provided by national law, in particular, any such rights against the seller that arise from a legally effective purchase contract.

2. The warranty regulations mentioned herein are applicable unless they constitute an infringement of national warranty law.

* Customers in the European Union please contact BEHRINGER Germany Support for further details.

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