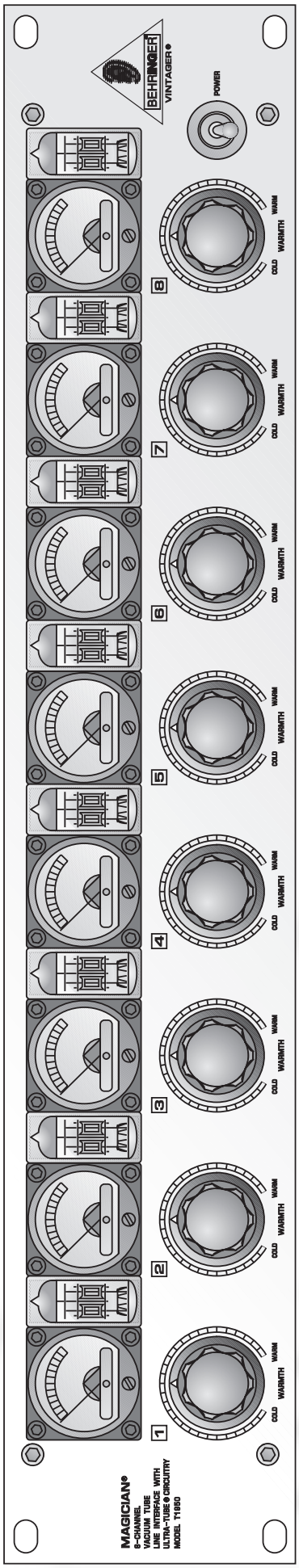
MAGICIAN®

T1950



User´s Manual

Bedienungsanleitung

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Version 1.0 December 1998

BEHRINGER®

www.behringer.de

CE

EC-Declaration of Conformity

BEHRINGER®

INTERNATIONAL GmbH

acc. to the Directives 89/336/EWG and 73/23/EWG

We, **BEHRINGER INTERNATIONAL GmbH**

Hanns-Martin-Schleyer-Straße 36-38

D - 47877 Willich

Name and address of the manufacturer or the introducer of the product on the market who is established in the EC

herewith take the sole responsibility to confirm that the product:

MAGICIAN T1950

Type designation and article-N° (if applicable)

to which this declaration refers, is in accordance with the following standards or standardized documents:

- ☒ **EN 60065**
- ☒ **EN 55020**
- ☒ **EN 55013**
- ☒ **EN 61000-3-2**
- ☒ **EN 61000-3-3**

The following operation conditions and installation arrangements have to be presumed:

acc. to Operating Manual

BEHRINGER
INTERNATIONAL GmbH
Hanns-Martin-Schleyer-Str. 36-38
D-47877 Willich-Münchheide II
Tel.-Nr. 0 21 54 / 92 06-0
Fax-Nr. 0 21 54 / 92 06-30

B. Nier, President — Willich, 01.12.1998

Name, address, date and legally binding signature of the person responsible

SAFETY INSTRUCTIONS

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

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

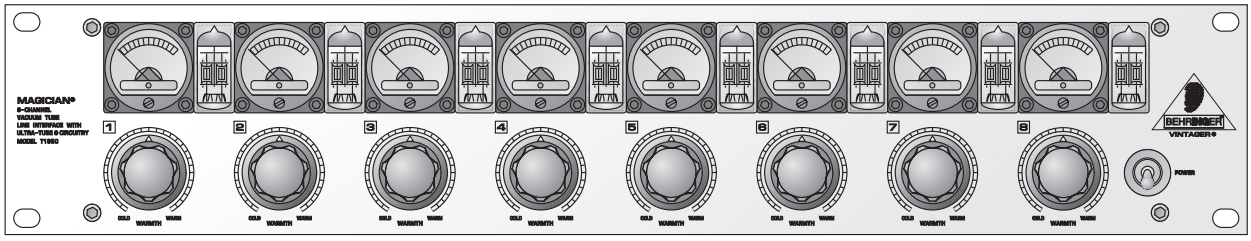
This symbol, wherever it appears, alerts you to important operating and maintenance instructions in the accompanying literature. Read the manual.

DETAILED SAFETY INSTRUCTIONS:
All the safety and operation instructions should be read before the appliance is operated.
Retain Instructions:
The safety and operating instructions should be retained for future reference.
Heed Warnings:
All warnings on the appliance and in the operating instructions should be adhered to.
Follow instructions:
All operation and user instructions should be followed.
Water and Moisture:
The appliance should not be used near water (e.g. near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool etc.).
Ventilation:
The appliance should be situated so that its location or position does not interfere with its proper ventilation. For example, the appliance should not be situated on a bed, sofa rug, or similar surface that may block the ventilation openings, or placed in a built-in installation, such as a bookcase or cabinet that may impede the flow of air through the ventilation openings.
Heat:
The appliance should be situated away from heat sources such as radiators, heat registers, stoves, or other appliance (including amplifiers) that produce heat.
Power Source:
The appliance should be connected to a power supply only of the type described in the operating instructions or as marked on the appliance.
Grounding or Polarization:
Precautions should be taken so that the grounding or polarization means of an appliance is not defeated.
Power-Cord Protection:
Power supply cords should be routed so that they are not likely to be walked on or pinched by items placed upon or against them, paying particular attention to cords and plugs, convenience receptacles and the point where they exit from the appliance.
Cleaning:
The appliance should be cleaned only as recommended by the manufacturer.
Non-use Periods:
The power cord of the appliance should be unplugged from the outlet when left unused for a long period of time.
Object and Liquid Entry:
Care should be taken so that objects do not fall and liquids are not spilled into the enclosure through openings.
Damage Requiring Service:
The appliance should be serviced by qualified service personnel when:
- The power supply cord or the plug has been damaged; or
- Objects have fallen, or liquid has been spilled into the appliance; or
- The appliance has been exposed to rain; or
- The appliance does not appear to operate normally or exhibits a marked change in performance; or
- The appliance has been dropped, or the enclosure damaged.

Servicing:
The user should not attempt to service the appliance beyond that is described in the Operating Instructions. All other servicing should be referred to qualified service personnel.

MAGICIAN

Professional multi-purpose 8-channel Tube Interface for high-end studio and stage applications



- ▲ Our new ULTRA-TUBE circuitry warms up your music without unwanted noise
- ▲ A special “Warmth” control lets you add the amount of tube sound you want
- ▲ Selected 12AX7 tubes for outstanding, ultra-musical tube sound
- ▲ Gives your music that extra sparkle and definition
- ▲ Releases untapped resources and additional details for any program material
- ▲ Allows analog signals to mantain all their warmth into a digital recorder
- ▲ Brings additional warmth and texture to your vocal tracks
- ▲ Provides vintage tube sound for guitar and any other instrument
- ▲ Adds warmth and presence to any mix
- ▲ Perfectly emulates the tape saturation effect of analog tape recording machines
- ▲ Servo-balanced gold-plated XLR and 1/4” TRS inputs and outputs
- ▲ Ultra-low noise 4580 audio operational amplifiers for superior sound performance
- ▲ High quality detent potentiometers and switches with authentic vintage style knobs
- ▲ Huge back-lit analog VU meters with stylish “Retro” design
- ▲ Exceptionally rugged construction ensures long life and durability
- ▲ Manufactured under the stringent ISO9000 management system

FOREWORD

Dear Customer,

We thank you for expressing your confidence in BEHRINGER products by purchasing the BEHRINGER MAGICIAN. It is one of my most pleasant tasks to write this preface, as our engineering team has made it possible to enhance the traditional tube circuitry design (particularly for our Vintager® series of products), and adapt it to meet the high sound quality and dynamics requirements of modern, pro-level audio technology. The fact that we are still fascinated by "antique" tube radios and amps as well as the fine and warm tonal character that we usually associate with them, are the reasons why vacuum tubes have kept their ground even in state-of-the-art circuit topologies used especially in professional audio technology or high-end devices. We are particularly proud that we have found an extremely effective symbiosis between solid-state and tube technologies making them affordable to anybody interested in audio technology. As always, our top-priority concern when developing this device was the demanding end user, in other words: you. It was our major goal to meet your demands. Sure, it meant a lot of hard work to develop such a product, but the fun has made it all worthwhile. The shine in the eyes of the many interested musicians at the Music Fair 1997, when they saw our Vintager models for the first time, was a lasting incentive driving our development efforts.

It is our philosophy to share our joy with you, because you are the most important member of the BEHRINGER family. With your highly competent suggestions for new products you've greatly contributed to shaping our company and making it successful. In return, we guarantee you uncompromising quality (manufactured under the ISO9000 certified management system) as well as excellent technical and audio properties at an extremely favorable price. All of this will enable you to fully unfold your creativity without being hampered by budget constraints.

We are often asked how we can make it to produce such high-grade devices at such unbelievably low prices. The answer is quite simple: it's you, our customers! Many satisfied customers means large sales volumes enabling us to get better conditions of purchase for components, etc. Isn't it only fair to pass this benefit back to you? Because we know that your success is our success, too!

I would like to thank all people whose help on "Project MAGICIAN" has made it all possible. Everybody has made very personal contributions, starting from the designers of the unit via the many staff members in our company to you, the user of BEHRINGER products.

My friends, it's been worth the effort!

Thank you very much,

Uli Behringer

TABLE OF CONTENTS

1. INTRODUCTION

With the BEHRINGER MAGICIAN T1950 you have purchased an innovative 8-channel multifunctional Tube Interface which can be used both for recording/mixdown and dubbing or soundtrack applications. Preceding the rest of your audio chain equipment, it's an all-purpose device for any kind of digital and analog recordings and it will enable you to make your recordings sound much better - with little effort. The newly developed UTC circuit provides subtle sound enhancement rather than showy effects processing. In particular, digital workstations can be considerably enhanced in their sound character. You are free to use the MAGICIAN before the recording sessions or later when you mix down the music you recorded. You can also use it to brighten up entire MIDI productions or even movie sound recordings and thus give them their finishing touch.

Future-oriented BEHRINGER technology
With the exception of 8 selected 12AX7/ECC83 tubes, the MAGICIAN T1950 is based on SMD technology (Surface Mounted Devices). These subminiature components known from aerospace applications ensure both extreme packing density and greater reliability.

Sophisticated manufacturing
The TUBE MAGICIAN uses SMD technology (Surface Mounted Device). These subminiature components known from aerospace technology allow for an extreme packing density, plus the unit's reliability could be improved. Additionally, the unit is manufactured in compliance with the ISO9000 certified management system.

☞ **The following operational manual will introduce you to the BEHRINGER MAGICIAN and its various functions. After reading the manual carefully, make sure it is always on hand for future reference.**

Use in music productions
In your daily studio work, the MAGICIAN can be used for a variety of applications that provide subtle sound enhancement. For example, it gives percussion instruments more "punch", or improves the transparency of other instruments, particularly those rich in upper harmonics. The source material is enriched in sound volume and brilliance. Enhanced "depth" makes it easier to locate individual instruments. Vocal sounds gain in presence and volume, without masking other instruments. Thus, voices become a more integral part of the overall mix. Synthetic sounds, especially MIDI keyboard sounds become more real and natural with the MAGICIAN. So, with the MAGICIAN you can adopt a more active approach during the mixdown process and work out subtleties, while focusing particularly on the musical aspects of your recordings.

1.1 The design concept

Quality
The philosophy behind BEHRINGER products guarantees a no-compromise circuit design and employs the best choice of components. The op-amps, type 4580, used in the MAGICIAN are chosen for their superior signal-to-noise ratio, low distortion and linear performance. Additionally, the MAGICIAN uses high quality resistors and capacitors with very tight tolerances, high-grade switches as well other selected components.

Tubes
The MAGICIAN uses 12AX7 / ECC83 tubes. These triodes are capable of handling a large dynamic range with little microphony. Add to this their relative ruggedness and above average life span and you can see why it's one of the most popular and reliable pre-amp tubes on the market. These features also ensure you their availability for many years to come.

Balanced inputs and outputs
As standard, the BEHRINGER MAGICIAN is installed with electronically servo-balanced inputs and outputs. The new circuit design features automatic hum and noise reduction for balanced signals and thus allows for trouble-free operation, even at high operating levels. Externally induced mains hum etc. will be effectively suppressed. The automatic servo-function recognizes the presence of unbalanced connectors and adjusts the nominal level internally to avoid level differences between the input and output signals (correction 6 dB).

1.2 Before you begin

Your BEHRINGER MAGICIAN was carefully packed in the factory and the packaging was designed to protect the unit from rough handling. Nevertheless, we recommend that you carefully examine the packaging and its contents for any signs of physical damage, which may have occurred in transit.

☞ **If the unit is damaged, please do not return it to us, but notify your dealer and the shipping company immediately, otherwise claims for damage or replacement may not be granted. Shipping claims must be made by the consignee.**

The BEHRINGER MAGICIAN fits into two standard 19" rack units of space (3 1/2" / 89.5 mm). Please allow at least an additional 4" (±10 cm) depth for the connectors on the back panel.

☞ **Be sure that there is enough space around the unit for cooling and please do not place the MAGICIAN on high temperature devices such as power amplifiers etc. to avoid overheating.**

The mains connection of the MAGICIAN is made by using the supplied cable. It meets all of the international safety certification requirements. Please make sure that all units have a proper ground connection.

☞ **Before you connect your MAGICIAN to the mains, please make sure that your local voltage matches the voltage required by the unit!**

As a standard the audio inputs and outputs on the BEHRINGER MAGICIAN are fully balanced. If possible, connect the unit to other devices in a balanced configuration to allow for maximum interference immunity. The automatic servo function detects unbalanced connections and compensates the level difference automatically (6 dB correction).

1.3 Control elements

The BEHRINGER MAGICIAN has eight identical channels. Each channel comes with a Warmth control, a backlit VU Warmth meter and a tube window.

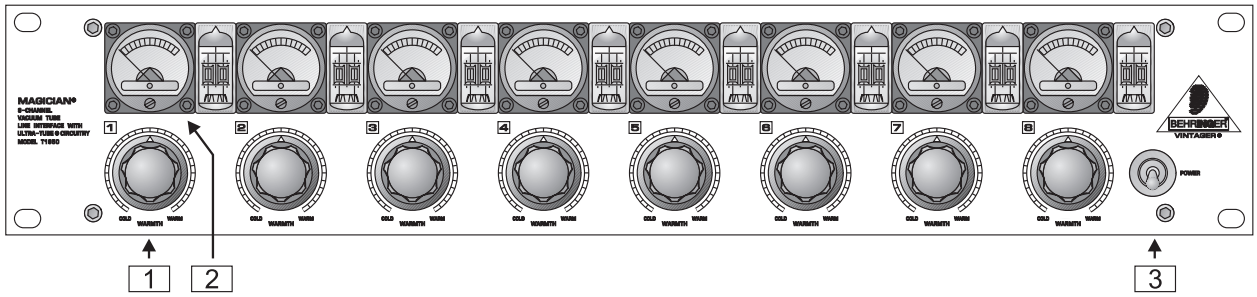


Fig. 1.1: control and display elements on the front panel

1 The Warmth control adjusts the amount of upper harmonics added to the original signal.

2 The Warmth meter allows you to monitor the amount of added upper harmonics.

3 Use the Power switch to turn on the BEHRINGER MAGICIAN.

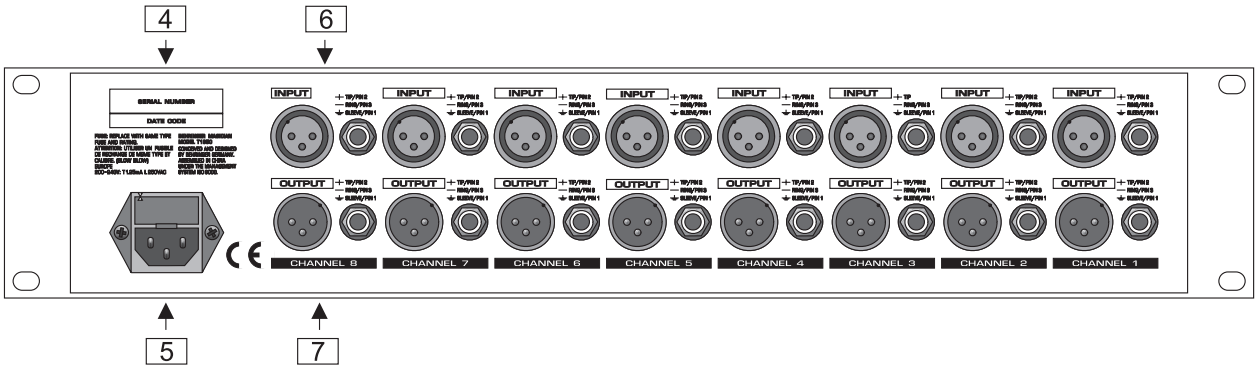


Fig. 1.2: Rear panel connectors of the BEHRINGER MAGICIAN

4 Please take the time and ask your dealer to fill in the warranty card. Then return it within 14 days after the date of purchase. Otherwise, you will lose your extended warranty rights. Please check that the series number on the unit is the same as the one indicated in the warranty card.

5 Before you connect the unit you should check that the voltage indicator on the voltage selector matches your local line voltage. When you need to replace the fuse, please insert a fuse of the same type and rating.

The MAGICIAN is connected to the mains via an IEC power connector. A suitable power cord is enclosed. Please also note the instructions given in the “APPLICATIONS” Chapter.

6 The inputs are located on the rear panel. Both balanced 6.3 mm TRS jacks and XLR connectors can be used.

7 On the output side, the TRS jacks and XLR connectors are each wired in parallel.

2. OPERATION

The BEHRINGER MAGICIAN uses our newly developed ULTRA-TUBE® technology, a development resulting from two years of intensive research work by our engineering team. The ULTRA-TUBE technology overcomes the problems related to tube circuitry (see Chapter 1) and generates upper harmonics, even at low saturation levels, to give your recordings more warmth and power.

3. APPLICATIONS

This Chapter gives you some hints as to typical applications of the MAGICIAN, thus enabling you to use the unit as efficiently as possible.

Please take the time to thoroughly study the example applications so that you can fully exploit the variety of functions your BEHRINGER MAGICIAN has in store.

3.1 Recordings with the MAGICIAN

When you insert the MAGICIAN between your mixing console and multi-track recorder, the sound modifications produced by this device will be directly recorded on tape or hard-disk. For this purpose, connect the tape sends (subgroup outputs) of the mixing console with the inputs on the MAGICIAN, then connect the unit's outputs to the analog inputs on your multi-track recorder. As mixing consoles generally have balanced tape sends and returns, we recommend that you wire the MAGICIAN in a balanced configuration.

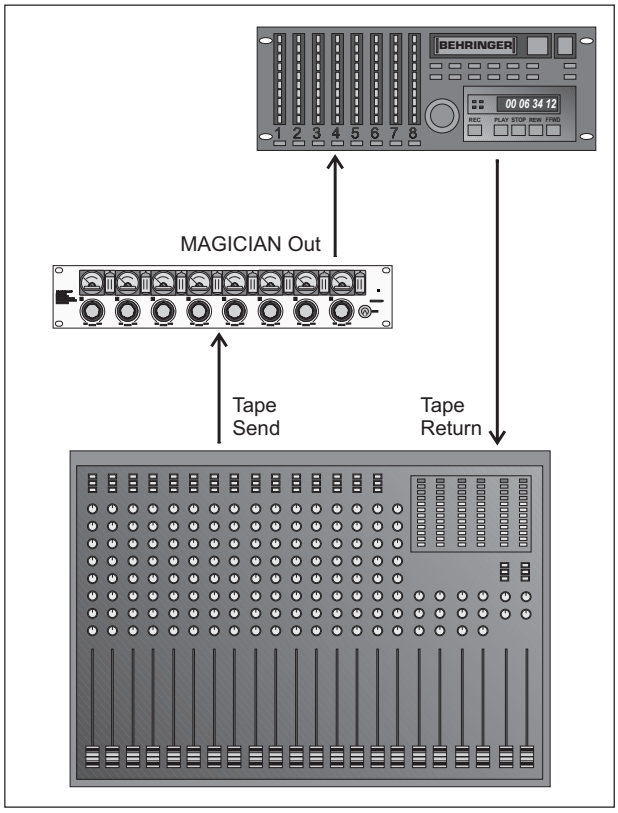


Fig. 3.1: the MAGICIAN between mixing console and multi-track recorder

☞ **Some digital multi-track recorders have multi-pin connectors for balanced connection (i.e. to wire them in a balanced configuration you need an adapter). Crosstalk between the channels is therefore higher than in unbalanced configurations. In such a case, it will be wise to use long, balanced cables between mixing console and MAGICIAN, and short, unbalanced cables between MAGICIAN and digital multi-track recorder, so as to ensure proper signal separation between the single channels.**

3.2 Application in mixdown

Another possibility is to insert the MAGICIAN in the subgroups of the mixing console (if available). Depending on the wiring of the inserts on the console, you either need a special 6.3 mm stereo jack insert cable that is routed to two mono jacks (send & return), or two separate cables for the send and return path. Connect the insert sends of the subgroups to the inputs on the MAGICIAN, and the insert returns to the outputs.

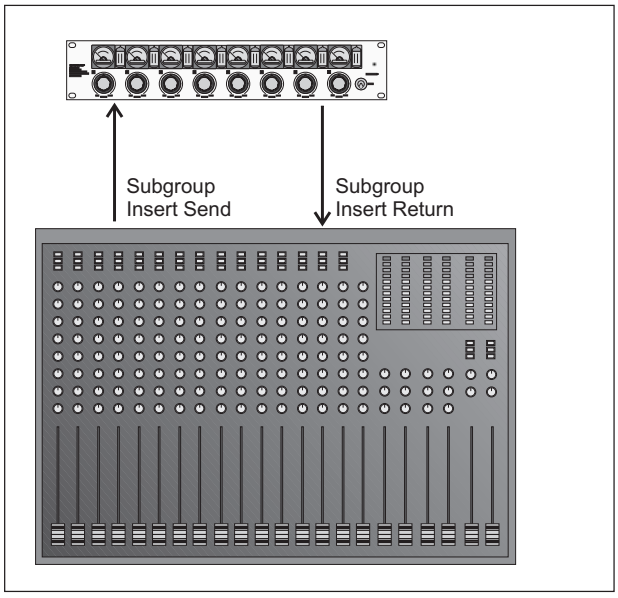


Fig. 3.2: MAGICIAN in subgroup inserts

You can also use the MAGICIAN for the mixdown by connecting it to the insert paths of the subgroups. Simply route the signal to be processed with the T1950 to the subgroups first, and then to the master bus. Thus, you can employ the MAGICIAN, for example, for complete MIDI productions. Additionally, the unit can be connected to the insert paths of the individual channels. Although this will not allow for processing several signals at the same time, it lets you tailor the sound of specific instruments or voices.

However, when using the inserts you should note that many mixing consoles have stereo insert jacks (tip = send, ring = return, shaft = mass/shield), i.e. the signals routed to the outside world are unbalanced.

If you can't do without balanced signal routing for the mixdown, we recommend that you use the following wiring scheme: connect the outputs of the multi-track recorder to the inputs of the MAGICIAN, and its outputs to the tape return inputs on the console, in order to maintain a balanced connection to the MAGICIAN during the mixdown.

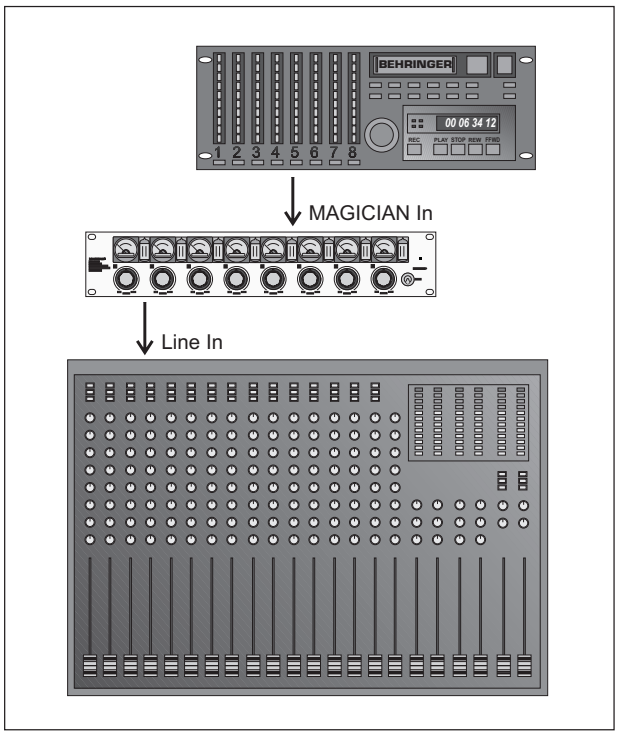


Fig. 3.3: MAGICIAN between multi-track recorder and mixing console

☞ **You should avoid controlling the MAGICIAN from the aux busses (Aux Sends & Returns) of the mixing console, because the signal generated by the T1950 includes the original and the effect signals. If you added this mixed signal to the original signal in the console, the resulting volume levels would be raised considerably.**

3.3 Copying with the MAGICIAN

To enhance the sound of existing recordings, you can wire the MAGICIAN between two multi-track recorders, so as to avoid the “detour” via the console (and the resulting deterioration of the signal-to-noise ratio). Simply copy the existing audio material from one multi-track recorder to the other, with the MAGICIAN inserted between them.

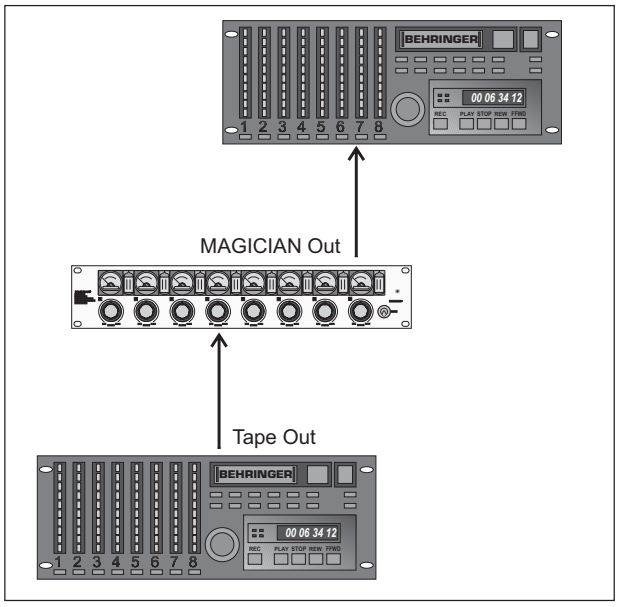


Fig. 3.4: MAGICIAN between two multi-track recorders

3.4 Versatility in studio environments

Another highly flexible application is the use of the MAGICIAN in combination with a patchbay which allows you to take the audio signals from the majority of your studio equipment at one central point and send it from there to other devices. Our ULTRAPATCH PRO PX2000 gives you the option of “collecting” the inputs and outputs of the MAGICIAN and freely connect them to other devices. For example, you could route the insert paths of the subgroups or the Tape Sends & Returns to the same or another patchbay. A decisive advantage of patchbay-based configurations is the quick access to the connectors of the MAGICIAN and a high degree of flexibility.

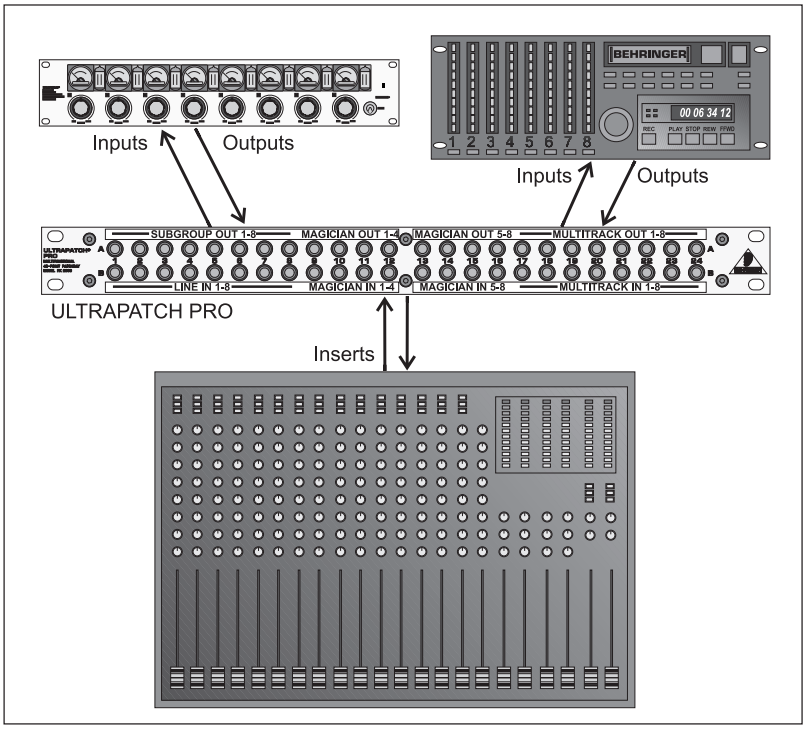


Fig. 3.5: Patchbay configuration around the MAGICIAN

4. TECHNICAL BACKGROUND

4.1 Tube history

Due to many patent litigations, it is difficult to determine exactly when the tube was “born”. First developments in tube technology were reported between 1904 and 1906. It was a research task of that time to find a suitable method for receiving and rectifying high frequencies. On April 12, 1905, a certain Mr. Fleming was granted a patent for his “hot-cathode valve” which was based on Edison’s incandescent lamp. This valve was used as a rectifier for high-frequency signals. Robert van Lieben was the first to discover (probably by chance) that the anode current can be controlled by means of a perforated metal plate (grid), one of the milestones in the development of amplification tubes. In 1912, Robert van Lieben finally developed the first tube for the amplification of low-frequency signals. Initially, the biggest problem was to produce sufficient volume levels, which is why resonance step-ups (though impairing the frequency response) were used to maximize the attainable volume. Later, the objective was to optimize the electroacoustic transducers of amplifiers in such a way that a broad frequency band could be transmitted with the least distortion possible. However, a tube-specific problem is its non-linear amplification curve, i.e. it modifies the sound character of the source material. Despite all efforts to ensure a largely linear frequency response, it had to be accepted that tube devices produce a “bad” sound. Additionally, the noise floor generated by the tubes limited the usable dynamics of connected storage media (magnetic tape machines). Thus, a one-to-one reproduction of the audio signal’s dynamics (expressed as the difference between the highest and lowest loudness levels of the program material) proved impossible. To top it all, tube devices required the use of high-quality and often costly transducers and sophisticated voltage supplies.

With the introduction of semiconductor technologies in the field of audio amplification it soon became clear that the tube would have to give way to the transistor, as this device featured an enormously enhanced signal-to-noise ratio, less complex power supply and improved frequency response. Plus, semiconductor-based circuits can be realized much more easily - for less money. Two decades later, the introduction of binary signal processing meant the beginning of a new era of recording media that provided plenty of dynamic response and allowed for loss-free copying of audio signals. As digital media were enhanced, however, many people began to miss the warmth, power and liveliness they knew from analog recordings. This is why purists still today consider digital recordings as “sterile” in sound.

4.2 Design and functional principle of tubes

Tubes can be roughly classified according to the number of electrodes they use. There are tubes with two, three or five electrodes usually referred to as diodes, triodes or pentodes.

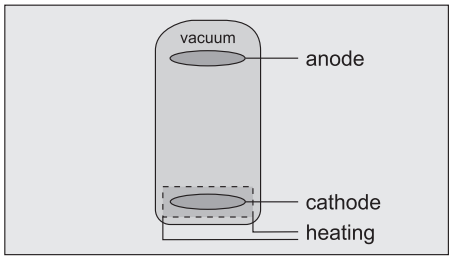


Fig. 4.1: Diode

The diode contains two electrodes in a vacuum glass bulb that have electrical connection to the outside. The vacuum allows for a free movement of electrons. When one of the electrodes is heated up (= thus becoming a cathode), it begins to emit electrons. When a positive DC voltage is applied to the other electrode (= anode), the negative electrons start to wander from the cathode to the anode. With reverse polarity between cathode and anode, a current flow is not possible because the unheated anode emits more or less no electrons. This design was used, for example, as a rectifier in the power supplies of amplifiers. The magnitude and velocity of the flow of electrons depend on the cathode's temperature, the material it consists of, and the magnitude of the anode voltage. When the electrons hit the anode they produce heat that is dissipated by using large anode plates.

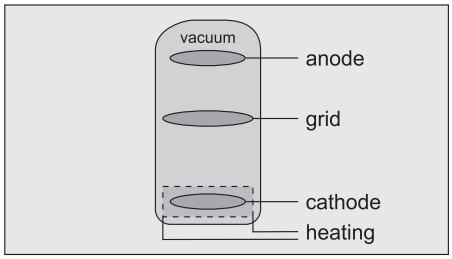


Fig. 4.2: Triode

The triode has an additional metal grid between anode and cathode. By applying a negative voltage, this grid can be used to control the internal resistance of the tube, and hence the anode current. When the grid bias voltage (voltage between cathode and grid) becomes negative, the current flowing to the anode is reduced because the negatively charged grid repels the arriving electrons. As a consequence, there are less electrons to reach the anode. When the bias voltage is raised towards zero, the flow of electrons accelerates. When it finally becomes zero or even positive, the grid current begins to flow which considerably reduces the current flowing to the anode and can possibly destroy the tube. Triodes are most commonly used in pre-amps, often in pairs arranged in one tube (twin triode).

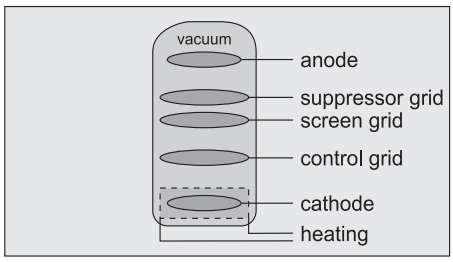


Fig. 4.3: Pentode

In a triode the capacitance between grid and anode is a problem with regard to high frequencies and large amplification factors. For this reason, the pentode has a positively charged screen grid between the control grid and the anode. However, the positive charge of the screen grid attracts electrons emitted from the anode plate when it is hit by arriving electrons. To prevent this electron emission, a decelerating or suppressor grid is placed between anode and screen grid. As it is negatively charged it blocks the electrons, so that they cannot reach the screen grid. Pentodes are most commonly used in power stages.

4.3 Properties of tubes

In general, the saturation (overdriving) of both transistor and tube-based circuits results in various types of distortion. These phenomena are quite complex in the real world, but for the sake of a straightforward mathematical description we are going to classify them as linear and non-linear distortion. Linear distortion is produced by frequency-dependent amplification or attenuation processes such as occurs in all kinds of filters and equalizers. Linear-distortion signals have the same frequency portions both on the input and output sides, but with different phase positions and amplitudes. Non-linear distortions have additional harmonics and distortion components that were not contained in the original input signal.

For example, when the plainest of all oscillations, a sine wave with a fixed frequency f, is overdriven, new oscillations with frequencies of 2*f, 3*f, etc. (integral multiples of the original frequency) are produced. These new frequencies are referred to as upper harmonics grouped as odd and even harmonics. Unlike the transistor, saturated tubes mostly produce even harmonics which are perceived by the human ear as more pleasant in sound than odd harmonics. Another important aspect lies in the fact that tubes produce distortion more gradually than transistors, which is why we speak of the ‘saturation’ of a Tube Stage. When you overdrive a transistor you get a sudden square deformation of the sine signal applied at the input, which produces an extreme harmonic spectrum at the output.

Non-linear distortions are measured with a distortion factor that consists of the total harmonic distortion [k] and partial harmonic distortions [kn]. The latter are defined as the ratio between the voltage of a single harmonic and the voltage of the distorted overall signal. Thus, the content of even harmonics is expressed as k2, k4, ... and that of odd harmonics as k1, k3, ...

$$k_n = \frac{U_n}{U_{ges}}$$

Formula for calculating partial harmonic distortion

The total harmonic distortion is the root of all squared distortion factors of the second and third degrees. Since the higher harmonics have only little impact on the measured results, they can be neglected.

$$k = \sqrt{k_2^2 + k_3^2}$$

Formula for calculating total harmonic distortion

In tube circuits the distortion factor k2 is used to describe an effect which the human ear classifies as “pleasant”. Also the frequency bands in which distortion occurs play an important role because the human ear differentiates very clearly in the frequency range of human speech.

4.4 The best of both worlds

Despite many efforts neither manufacturers nor developers have succeeded so far in simulating these positive properties of the tube by means of other devices. Additionally, the natural capabilities of the tube to act as a soft Limiter can only be mimicked with highly sophisticated circuitry. Today’s studio technology requirements are therefore met by a combination of both high-grade semiconductor and tube technologies. In this context, tubes no longer serve their original purpose as amplifiers, but are used for the detailed shaping of sound.

4.5 UTC circuit

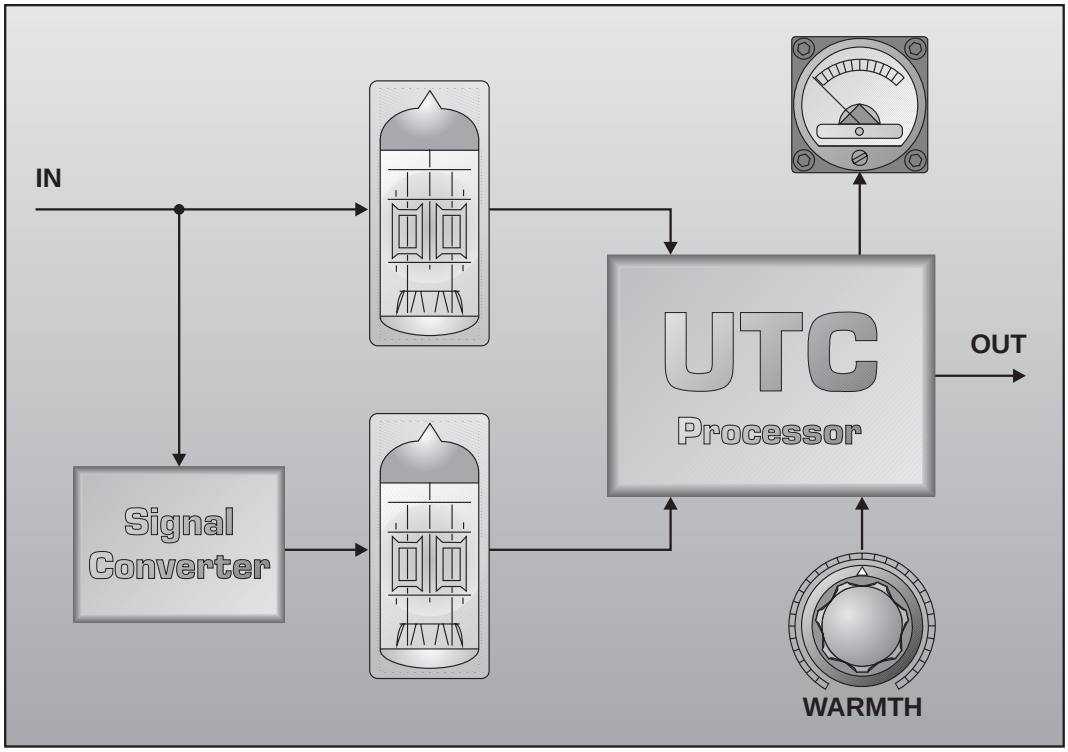


Fig. 4.4: UTC circuit

The MAGICIAN splits up the audio signal applied at the input, and processes it differently for both signal paths. Each of the two tube halves amplifies the original signal and the signal modified in its phase spectrum (twin triode, see Chapter 1.1.2). Additional harmonics are produced by slightly overdriving the Tube Stage. When the two signals are processed by the UTC circuit, the interference noise found in conventional tube circuits can be largely eliminated, and the actual tube effect be added gradually. The more you turn the Warmth control to the right, the more tube sound will be added to the original signal.

A closer look at developments and trends in audio technology shows that tubes are currently enjoying a renaissance, in a time when even amateur musicians are free to use digital effects processors and recording media, and ever more affordable digital mixing consoles are becoming a natural part of the equipment of many semiprofessional studios. Manufacturers try, with ever new algorithms, to get the most out of DSP's (Digital Signal Processors), the heart of any digital system.

Still, many audio engineers, particularly old hands often prefer using both old and new tube-equipped devices. As they want to use their warm sound character for their productions, they are ready to accept that these "goodies" produce a higher noise floor than modern, transistor-based devices. As a consequence, you can find a variety of tube-based microphones, equalizers, Pre-amps and compressors in today's recording and mastering environments. The combination of semiconductor and tube technologies gives you the additional possibility of using the best of both worlds, while being able to make up for their specific drawbacks.

4.6 Studio applications

In a recording studio tubes do not pervorm the same task as they do in an overdriven guitar amp, where the considerably higher saturation of the tube(s) leads to a full and often deliberate modification of the input signal (in many cases combined with a heavy increase in noise floor levels). In the studio more subtle effects are needed. Here, tube circuits add life to the signal's tonal character and increase its power to make itself heard. Often, tubes also increase the signal's perceived loudness (in relation to the unprocessed signal), i.e. the perceived loudness goes up although the volume level remains the same. This is because the dynamic range of the applied audio signal is limited by the tube circuit, while the amplitude of the signal with the lowest loudness is raised. Thus, increasing tube saturation produces a slight compression effect over the entire dynamic range.

A similar effect can be perceived when analog tape is saturated. This saturation effect also compresses the recorded audio material and produces additional harmonics.

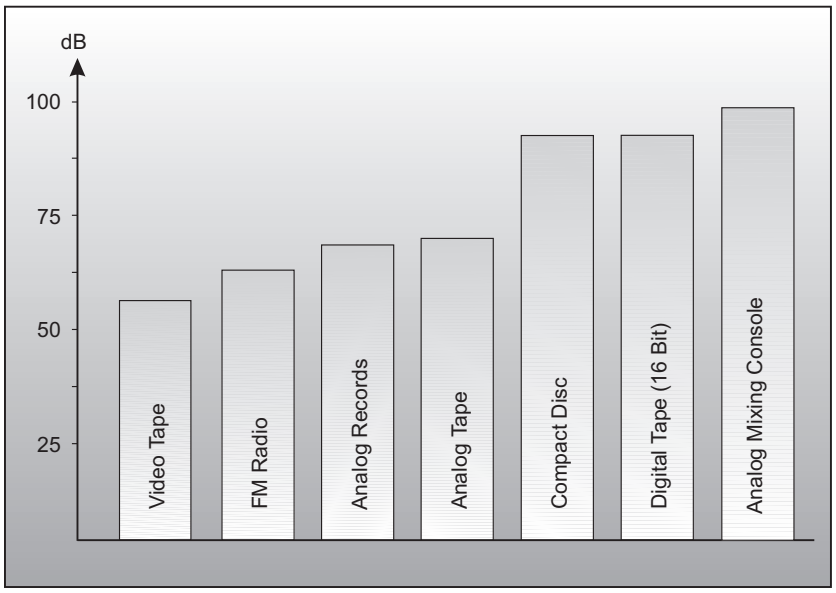


Fig. 4.5: Dynamic range of various media

4.7 Tubes used in the MAGICIAN

The BEHRINGER MAGICIAN is equipped with 8 selected 12AX7/ECC83 tubes. These triode tubes feature a wide dynamic range and they are less susceptible to microphony. With their mechanical robustness and better-than-average service life they are among the most reliable and best selling pre-amp tubes on the market, ensuring their long-term availability.

☞ **Please make sure that the unit is set up and operated by qualified personnel only. Proper ground connection of the operators must be maintained both during and after installation because discharges, or similar effects, could impair the operational properties of the unit.**

5. INSTALLATION

Your BEHRINGER MAGICIAN was carefully packed in the factory and the packaging was designed to protect the unit from rough handling. Nevertheless, we recommend that you carefully examine the packaging and its contents for any signs of physical damage, which may have occurred in transit.

☞ **If the unit is damaged, please do not return it to us, but notify your dealer and the shipping company immediately, otherwise claims for damage or replacement may not be granted. Shipping claims must be made by the consignee.**

5.1 Rack mounting

The BEHRINGER MAGICIAN fits into one standard 19" rack unit of space (3 1/2" / 89.5 mm). Please allow at least an additional 4" depth for the connectors on the back panel. Be sure that there is enough air space around the unit for cooling and please do not place the MAGICIAN on high temperature devices such as power amplifiers etc. to avoid overheating.

5.2 Mains connection

The mains connection of the MAGICIAN is made by using a mains cable and a standard IEC receptacle. It meets all of the international safety certification requirements.

☞ **Please make sure that all units have a proper ground connection. For your own safety, it is advisable not to remove the ground connection within the units or at the supply, or fail to make this connection at all.**

The audio ground of the MAGICIAN is internally capacitor de-coupled, to isolate it from the supply earth. It is therefore not advantageous to attempt ground loop problem solving using this method.

Before you switch on the unit, check that it is configured to match your AC mains voltage requirements. If it does not comply, then it is necessary to switch the operating voltage to the correct supply requirements BEFORE turning on the unit, otherwise the unit could be severely damaged. You will find this combined fuse holder/voltage selector at the back, adjacent to the IEC receptacle. **IMPORTANT: This does not apply for general export models which are built for one operating voltage only.**

The AC voltage selection is defined by the position of the fuse holder. If you intend to change the operating voltage, remove the fuse holder and twist it by 180 degrees before you reinsert it. Matching the two markers monitors the selected voltage.

☞ **If the unit is switched to another operating voltage, the fuse rating must be changed. See the technical specifications in the appendix**

A safety fuse protects the unit from serious defects. If the fuse blows, this is a warning sign and always indicates that the circuit is overloaded. The fault must always be repaired before the fuse is replaced. If the safety fuse is faulty and needs replacing after the unit is repaired, please make sure that you replace it only with the identical type and rating. NEVER use fuses of different ratings or cover faulty fuses with aluminium foil. This can cause fire and electric shocks and will endanger your life and the lives of others.

5.3 Audio connections

As standard, the BEHRINGER MAGICIAN is installed with electronically servo-balanced inputs and outputs. This circuit design features automatic hum and noise reduction for balanced signals and thus allows for trouble-free operation, even at high operating levels. Externally induced mains hum etc. will be effectively suppressed. The automatic servo-function recognizes the presence of unbalanced connectors and adjusts the nominal level internally to avoid level differences between the input and output signals (correction 6 dB).

☞ **Please ensure that only qualified persons install and operate the MAGICIAN. During installation and operation the user must have sufficient electrical contact to earth. Electrostatic charges might affect the operation of the MAGICIAN!**

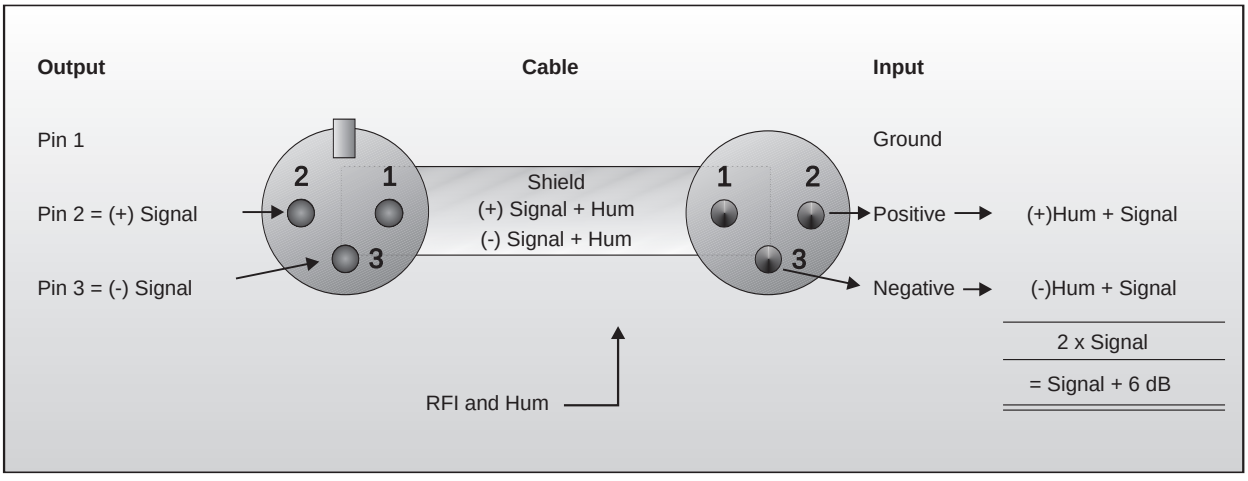


Fig. 5.1: Compensation of interference with balanced connections

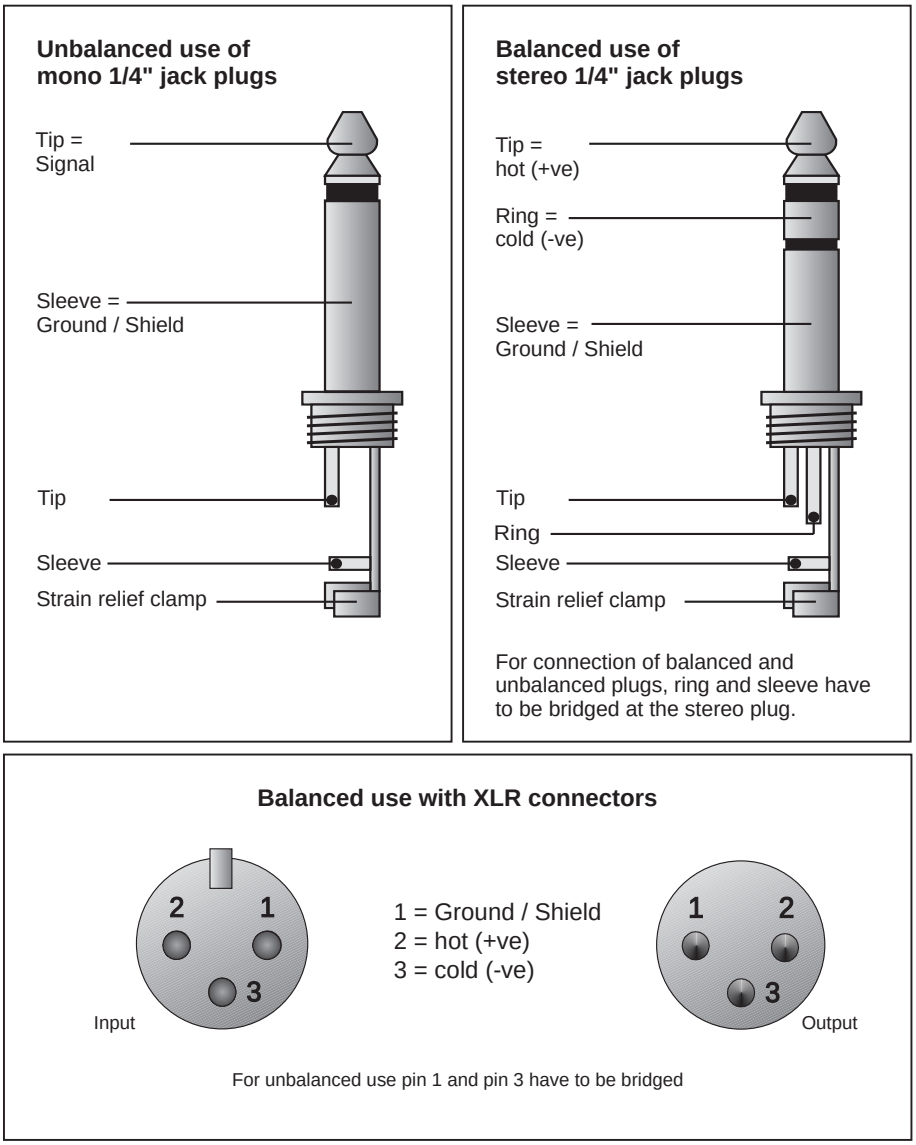


Fig. 5.2: Different plug types

6. SPECIFICATIONS

Audio input		
Connectors	XLR and 1/4” jack	
Type	transformerless, DC-decoupled input	
Impedance	50 kOhm balanced, 25 kOhm unbalanced	
Maximum input level	+23 dBu balanced and unbalanced	
CMRR	typ. 40 dB, >55 dB @ 1kHz	
Audio output		
Connectors	XLR and TRS 1/4" jack	
Type	electronically servo-balanced output stage	
Impedance	60 Ohms balanced, 30 Ohm unbalanced	
Max. output level	+21 dBu, +20 dBm balanced and unbalanced	
System specifications		
Bandwidth	10 Hz to 200 kHz, +/- 3 dB	
Signal-to-noise ratio	>100 dB, unweighted, 22 Hz to 22 kHz	
THD	0.011 % typ. @ +4 dBu, 1 kHz, Gain 1	
IMD	0.01 % typ. SMPTE	
Power supply		
Mains voltages	USA/Canada	~ 120 V AC, 60 Hz
	U.K./Australia	~ 240 V AC, 50 Hz
	Europe	~ 230 V AC, 50 Hz
	general Export Model	~ 100-120 V AC, ~ 200-240 V AC, 50-60 Hz
Power consumption	65 Watts	
Fuse	100-120 V AC: **2.5 A (slow-blow)**	
	200-240 V AC: **1.25 A (slow-blow)**	
Mains connection	standard IEC receptacle	
Physical		
Dimension	3 1/2" (89.5 mm) * 19" (482.6 mm) * 8 1/2" (217 mm)	
Net weight	8.0 kg	
Shipping weight	10.0 kg	

7. WARRANTY

§ 1 WARRANTY CARD

To be protected by this warranty, the buyer must complete and return the enclosed warranty card (signed/stamped by retail dealer) within 14 days of the date of purchase to BEHRINGER INTERNATIONAL (address see § 3). Failure to return the card in due time (date as per postmark) will void any extended warranty claims.

§ 2 WARRANTY

1. BEHRINGER INTERNATIONAL 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 any defects occur within the specified warranty period that are not caused by normal wear or inappropriate use, BEHRINGER INTERNATIONAL shall, at its sole discretion, either repair or replace the product.

2. If the warranty claim proves to be justified, the product will be returned freight prepaid by BEHRINGER INTERNATIONAL within Germany. Outside of Germany, the product will be returned at the buyer's expense.

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

§ 3 RETURN AUTHORIZATION NUMBER

1. To obtain warranty service, the buyer must call BEHRINGER INTERNATIONAL during normal business hours BEFORE returning the product (Tel.: +49 (0) 21 54 / 92 06 66). All inquiries must be accompanied by a description of the problem. BEHRINGER INTERNATIONAL will then issue a return authorization number.

2. The product must be returned in its original shipping carton, together with the return authorization number, to the following address:

BEHRINGER INTERNATIONAL GmbH
Service Department

Hanns-Martin-Schleyer-Str. 36-38

D - 47877 Willich-Münchheide

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 an original retail dealer's invoice. Any product deemed eligible for repair or replacement by BEHRINGER INTERNATIONAL under the terms of this warranty will be repaired or replaced within 30 days of receipt of the product at BEHRINGER INTERNATIONAL.

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 INTERNATIONAL shall not be held responsible for any cost resulting from such a modification/adaptation.

3. Free inspections, maintenance/repair work and replacement of parts are expressly excluded from this warranty, in particular if caused by inappropriate use. Likewise, the warranty does not cover defects of expendable parts caused by normal wear of the product. Expendable parts are typically faders, potentiometers, switches and similar components.

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

- misuse, neglect or failure to operate the unit in compliance with the instructions given in the 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 that are caused by force majeure or by any other condition beyond the control of BEHRINGER INTERNATIONAL.

5. Any repair carried out by unauthorized personnel will void the warranty.

6. Products which do not meet the terms of this warranty will be repaired exclusively at the buyer's expense. BEHRINGER INTERNATIONAL will inform the buyer of any such circumstance. If the buyer fails to submit a written repair order within 4 weeks after notification, BEHRINGER INTERNATIONAL will return the unit C.O.D. with a separate invoice for freight and packing. Such cost 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 INTERNATIONAL.

§ 6 CLAIM FOR DAMAGES

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

§ 7 OTHER WARRANTY RIGHTS

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.

BEHRINGER INTERNATIONAL GmbH, Hanns-Martin-Schleyer-Str. 36-38, D-47877 Willich-Münchheide II
Tel. +49 (0) 21 54 / 92 06-0, Fax +49 (0) 21 54 / 92 06-30