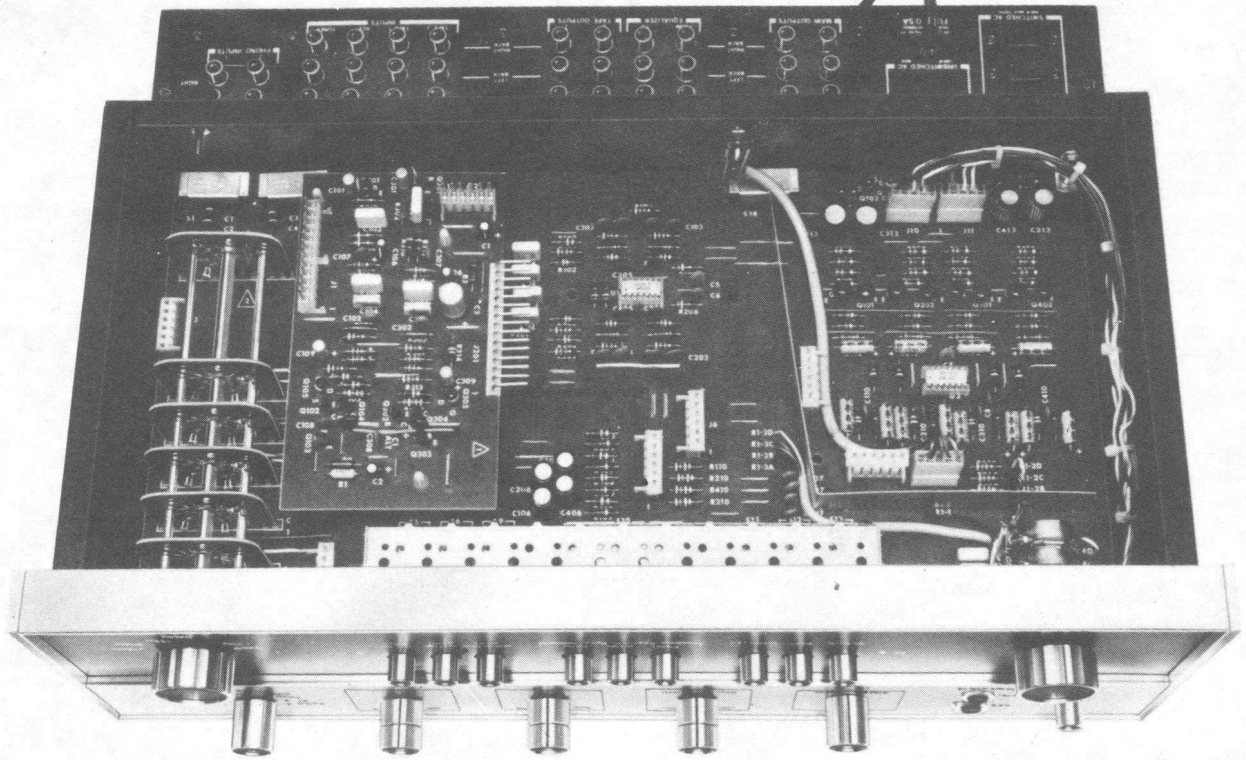


Herr Wichle



# Der neue Vorverstärker **BOSE 4401.**

**Ab Herbst in Deutschland.**

# ***BOSE***

BOSE EUROPA GmbH  
6 Frankfurt/M., Ginnheimer Str. 41  
Telefon (0611) 708062

Sehr geehrter BOSE-Fachhändler,

es freut uns, dass wir Ihnen heute die neueste Entwicklung der BOSE CORPORATION auf dem HiFi-Gebiet vorstellen können:

den BOSE 4401 Vorverstärker

Dieser wurde - wie nicht anders zu erwarten - von Grund auf neu entwickelt und ist für alle Quadro-Verfahren vorbereitet, die jetzt und in den kommenden Jahren von praktischer Bedeutung sind.

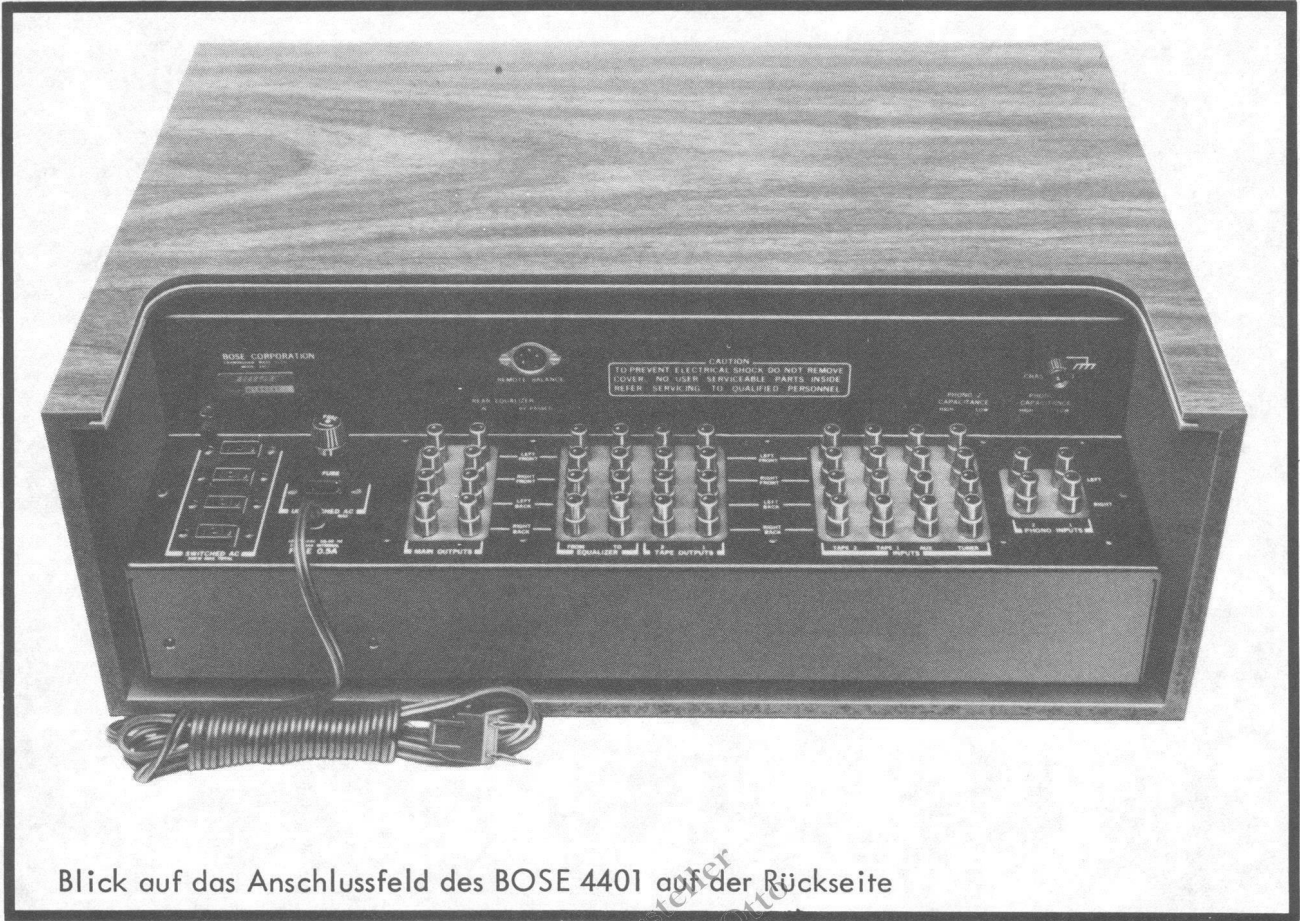
Die potentiellen Käufer dieses HiFi-Gerätes werden durch unsere Anzeigen in den Juli-Ausgaben von "HiFi-Stereophonie" und "fonoforum" über den BOSE 4401 vorinformiert. Da wir bewusst in diesen Anzeigen auf Einzelheiten verzichten, mit dem Zweck, die Leser zu einem Besuch in Ihrem Studio zu veranlassen, hier einige Vorteile des BOSE 4401:

- vier getrennte Kanäle
- Einschubmöglichkeiten von Modulen für SQ-Matrix Decoder (in full logic) und/oder CD-4 Demodulator und/oder 2 Aux-Decoder
- 4-Kanal-Kopfhörerausgang, umschaltbar auf hoch- und niederohmige Kopfhörer
- Getrennte Klangregler für Front- und Rear-Kanäle
- Gedruckte Schaltungen in Modulkauweise
- MET<sup>TM</sup> (Minimum Effective Temperature) Schaltkreise zur Reduktion der sog. effektiven Temperatur des Phono-Verstärker-Netzwerkes
- Anschlussbuchsen für Ein- und Ausgänge sind fester Bestandteil der gedruckten Schaltungen
- Schaltbare Phono-Eingänge für optimale Anpassung an konventionelle oder CD-4 Abtastsysteme
- Schaltbare Extra-Anschlüsse für externe Equalizer, Überbrückungsschalter für hintere Kanäle
- Klangregler und Klangfilter in Aufnahme- und Wiedergaberichtung wirksam
- Elektronische Unterdrückung schädlicher Ein- und Ausschaltimpulse
- Frequenzgang von 20 bis 20.000 Hz  $\pm$  0,2 dB
- Fremdspannungsabstand 100 dB (high level); 75 dB (phono)
- Abmessungen: Breite 46 cm, Höhe 15,2 cm, Tiefe 33,6 cm

Mit freundlichen Grüßen  
BOSE EUROPA GMBH

  
Hans Seitz

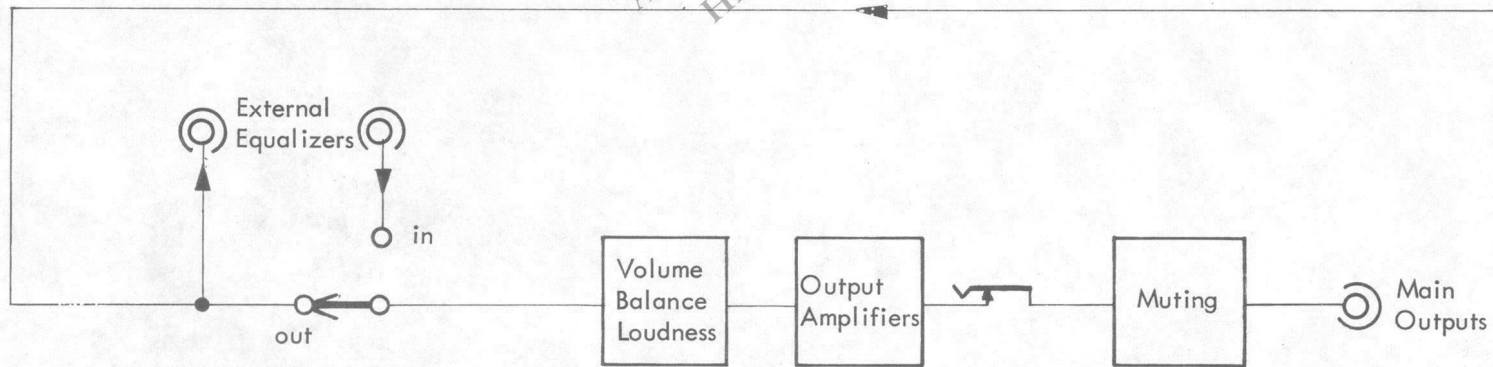
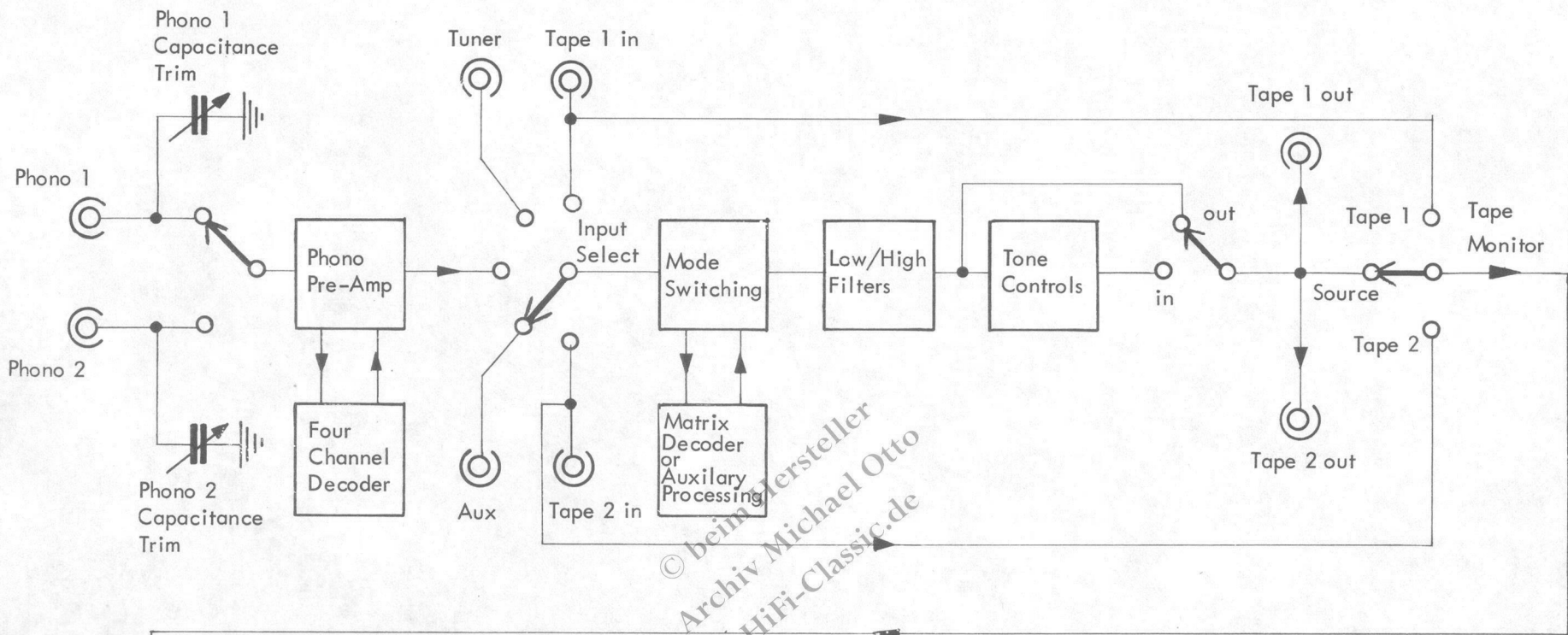
27. Juni 1974



Blick auf das Anschlussfeld des BOSE 4401 auf der Rückseite



Frontansicht BOSE 4401



**Block-Schaltbild BOSE 4401**

### III. BASIC DESCRIPTION AND A DISCUSSION OF SALIENT FEATURES

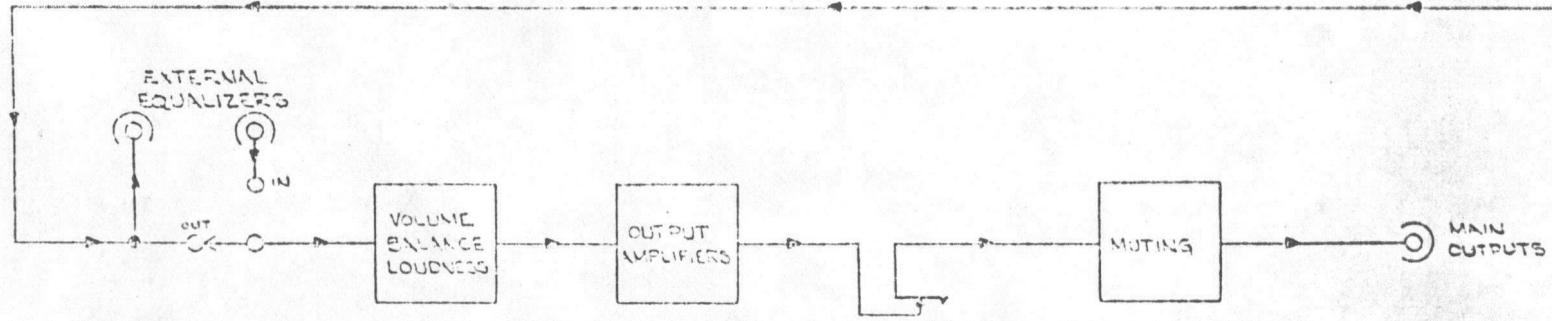
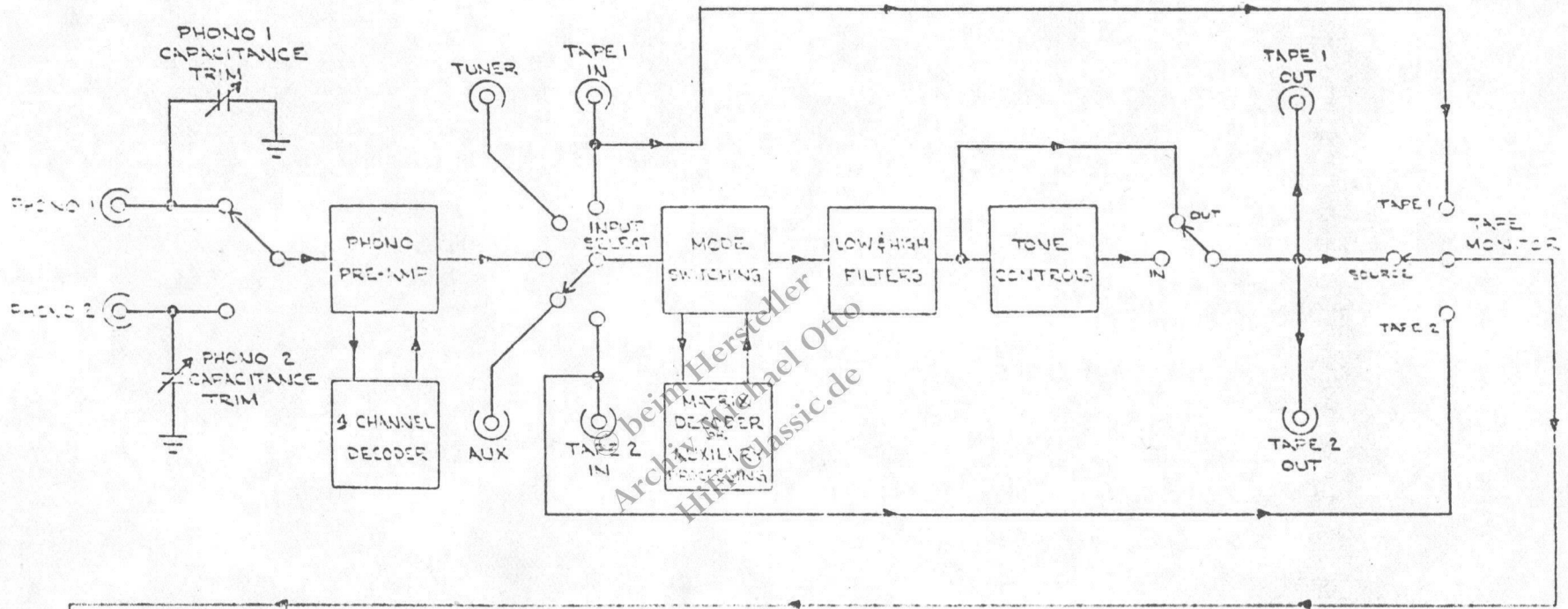
The 4401 will accept four-channel inputs from a tuner, two tape recorders, and another auxiliary device. In addition, two stereo phono inputs are provided. These phono inputs are designed to work with all current four-channel systems, including SQ, QS, and CD-4. The phono circuitry in the 4401 is also designed to be compatible with any future matrix or carrier type systems as well as the present ones.

The 4401 will operate equally well in both stereo and four-channel systems. Four-channel operation can be in the discrete mode or with one of the current coded systems, such as SQ and CD-4. Future developments in decoding systems and signal processing can be incorporated directly within the 4401.

#### Features

##### 1. Tape Recorder Connections

The signal flow in the 4401 is depicted in the block diagram on the next page. The main differences between the 4401 and conventional units in a block diagram sense are the tape recorder connections. In the 4401, the tape recorder outputs are taken after the tone controls, filters, mode selector, and matrix decoders. This connection allows the user to compensate his recording using the 4401 controls. The tape monitor function works in the usual manner, allowing the user to instantly compare the signal going into the tape recorder with that coming off the recorder. Note that outputs are provided simultaneously to both the TAPE 1 and TAPE 2 output jacks. This allows recording on two tape machines simultaneously. The tape monitor also allows monitoring of either machine during recording. This beneficial feature is obtained with no sacrifice in the usual playback features, as can be seen from the block diagram. Playback from a tape recorder through the input selector feeds the signal through all functions of the preamp, so that full flexibility is maintained during both recording and playback.



4401 BLOCK DIAGRAM

## 2. Full Three-Way Balance

The balance controls on the 4401 allow complete four-channel balancing capability. Unlike a joystick control, which provides only two degrees of freedom, the three controls on the 4401 allow diagonal balancing in addition to left-right and front-rear balancing. The controls are also designed so that the stereo user need be concerned only with the left-right balance as in any stereo preamp.

## 3. Headphone Amplifiers

The headphone amplifiers in the 4401 are capable of driving all dynamic headphones regardless of impedance. Both low and high impedance headphones are easily driven to extremely loud levels without the need for a separate power amplifier.

## 4. Electronic Muting of Transients

The electronic delay circuitry in the 4401 eliminates turn-on and turn-off transients from most components of the user's system.

## 5. Provision for External Equalizers

The 4401 allows connection of an external equalizer or other signal processing device in each of its four channels. These jacks provide a break in the signal path when selected by the front panel "EXTERNAL EQUALIZER" switch. For convenience, when using an equalizer in only the front channels of the 4401, a switch is provided that automatically bypasses the rear channels, eliminating the need for additional cables.

## 6. Phono Capacitance Switch

Input capacitance selection is provided on the 4401. With this feature each phono input may be individually matched to its particular cartridge. The two positions allow optimum matching to both stereo cartridges and to the new CD-4 cartridges available on the market.

## 7. Ultra-Quiet Phono Preamp

A new, very quiet phono preamp was designed for the 4401 using MET<sup>TM</sup> (Minimum Effective Temperature) circuitry. Instead of designing for minimum noise output with the input shorted, we designed a preamp which would have a minimum noise contribution with a cartridge connected to the preamp. Our design optimized noise figure and not signal-to-noise ratio. The result of noise figure optimization, together with MET circuitry, accounts for the ultra-quiet operation of the phono preamp.

## 8. Plug-In Modular Construction

The plug-in circuit cards designed for the 4401 provide its current flexibility and prevent it from becoming obsolete in future years. The use of plug-ins allows each user to tailor his system to his precise needs without forcing him to purchase options that he does not need nor want. The use of plug-ins allows for future circuits to be installed directly within the 4401.

## 9. Options

A walnut grain enclosure is available for the 4401. The present four-channel options are an SQ decoder, a CD-4 decoder, and a remote balance/volume unit. Even if all of the above options are used with a 4401, there is still room for one extra plug-in that allows for future developments in the audio field.

Ease of operation has not been sacrificed to provide flexibility in the 4401. The combination of simplicity and flexibility should make the 4401 especially attractive to both stereo and quadrophonic users.

#### IV. A LOOK UNDER THE COVER

The 4401 virtually eliminates all hand wiring through the use of extensive P.C. construction. This method of construction provides more reliable, more consistent units and also allows easier servicing.

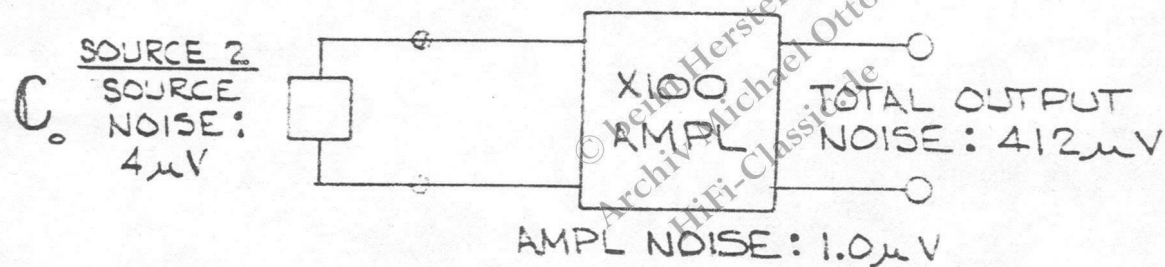
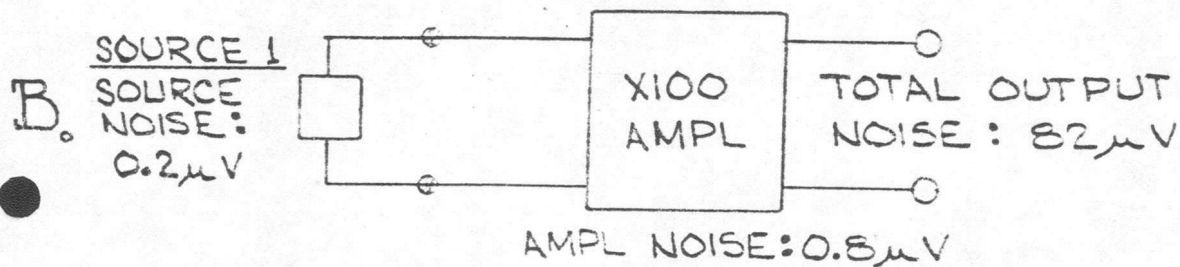
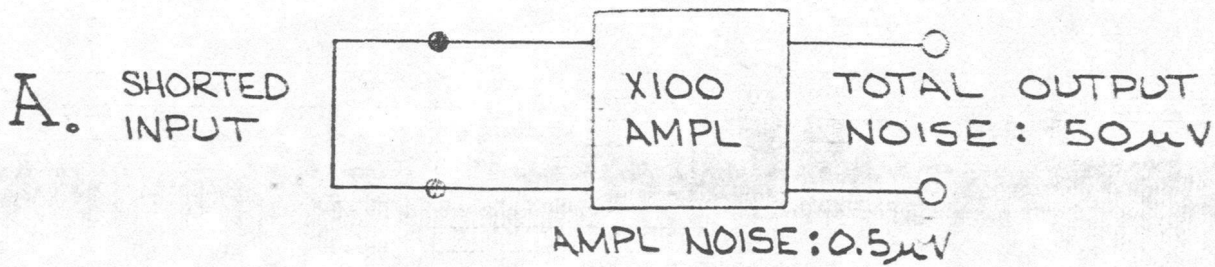
The 4401 makes extensive use of high quality operational amplifier circuitry in most of the high level stages. These provide a level of performance unobtainable with practical discrete circuits for the same cost. However, where it was decided that discrete circuitry could provide superior performance, this was used as in the phono preamp. In order to ensure that performance is consistently at a high level, multiple testing is done at the component level, subassembly level, and at the final assembly level. These tests are run by automated equipment on a 100% basis and include a final test sequence of over 100 steps.

© beim Hersteller  
Archiv Michael Otto  
HiFi-Classic.de

Basic Considerations In Low Noise Design

There are three facts which we must recognize if we are to understand the limitations on amplifier noise performance. First, we know that all real amplifiers generate some noise. Second, the noise generated by an amplifier is not an intrinsic characteristic of the amplifier but is a contribution which is affected by the source from which it is driven. In other words, the amplifier noise is dependent on the particular source with which it is associated. Third, and extremely important, is the fact that all real sources also generate noise. It is this fact that allows us to approach essentially ideal performance in an amplifier. All three of these phenomena must be considered if an optimum design is to be obtained.

What is a good figure of merit to describe the noise performance of an amplifier? Before answering this question, let us consider an amplifier as used in three different situations. We will assume our hypothetical amplifier to have a voltage gain of 100. We will consider first the situation depicted in A on the next page. Here, the amplifier is operating with shorted input. As can be seen, the output voltage under these circumstances is 50  $\mu$ volts. The equivalent input noise in this case is equal to 0.5  $\mu$ volt. (This looks pretty good.) Next, we will consider the situation shown in B. Here, our amplifier is connected to source 1. Under these conditions the amplifier now generates an equivalent input noise of 0.8  $\mu$ volt. The source also contributes some noise, in this case 0.2  $\mu$ volt. Using the usual mathematical rule for combining independent noise voltages, we find that the output voltage in this case is equal to 82  $\mu$ volts. Notice that the output noise voltage is increased due to two factors. First, the source is now generating noise whereas in case A there was no source noise. Second, the amplifier noise contribution is increased due to the fact that the source itself has changed.



SOURCE	TOTAL OUTPUT NOISE	TOTAL OUTPUT NOISE FROM IDEAL AMPL	RATIO OF ACTUAL: IDEAL OUTPUTS	AMPL NOISE
A SHORT	50	0	INFINITE	$0.5\mu\text{V}$
B SOURCE 1	82	20	12 DB	$0.8\mu\text{V}$
C SOURCE 2	412	400	0.3 DB	$1.0\mu\text{V}$

THREE CIRCUITS USING  
THE SAME  
NOISY AMPLIFIER

Now, let us look at the last case shown in C. Here we have connected the amplifier to a second source which we have called Source 2. In this case, the amplifier noise contribution has increased to 1.0  $\mu$ volt while the source generates 4  $\mu$ volts of noise. Again, using the usual rule, we find that the output voltage in this case is 412  $\mu$ volts. The data for these three situations are summarized in the chart at the bottom of the page. We have included on this chart the output that would be obtained in each case if we had an ideal amplifier and also the difference in performance between the ideal amplifier and the real amplifier. Looking at the chart, we see that in Case C our amplifier is practically indistinguishable from the ideal amplifier--if we could make one. Interestingly, the noise contribution in this case is the highest of all three, namely 1.0  $\mu$ volts. The reason for this apparent discrepancy is tied into the fact that the source is generating noise. Using the source as a basis of comparison, we may judge an amplifier's noise performance not by means of its absolute noise contribution, but rather in terms of its relative contribution when compared with the source. The measure obtained by comparing performance of the amplifier relative to the ideal situation, as given by the dB figures in the chart, is called noise figure, and is a commonly used engineering concept.

We may make some other interesting observations from the data in the chart. First, we observe that there is no single voltage noise that the amplifier generates. We cannot specify the amplifier noise contribution until we know the source to which it will be connected. Second, we can see that the noise performance of the amplifier can be good in certain cases and poor in others. In our example, the amplifier performs closer to the ideal with Source 2 connected than it does with Source 1 connected, even though the absolute noise contribution of the amplifier is higher with source 2 connected.

After reviewing the design of our phono preamplifier in the light of the above considerations, the design was optimized to the above figure of merit. The preamp section would be measured and specified in this

manner using noise figures. Limitations of the conventional approach to preamplifier design also became obvious under this scrutiny and led to other innovations which helped improve noise performance--BOSE MET (Minimum Effective Temperature) circuitry.

You may wonder why such a detailed analysis was performed for this particular circuit and yet not done in other stages of the preamp. The main reason for this is that the signal levels present at the high level inputs are usually sufficiently large so that the above noise analysis is not necessary from a practical point of view. If the high level stages of the preamp were in fact the noise limitation and it was desired to improve these by a significant amount (if possible), then the above analysis would become necessary to isolate those areas which are performing in a non-ideal manner.

© beim Hersteller  
Archiv Michael Otto  
HiFi-Classic.de

I. INTRODUCTION

The 4401 is a four-channel preamp that offers complete four-channel capability as well as stereo capability. The 4401 is a basic design, yet it offers unprecedented flexibility in both stereo and four-channel modes of operation. We believe the features provided, together with sound engineering design, make the 4401 an excellent unit.

ng

II. DESIGN PHILOSOPHY AND GOALS

The 4401 evolved out of a number of basic goals established before the product was designed. Once the basic decision to produce a four-channel unit was reached, the following guidelines were used during the development of the 4401:

1. Specifications must be meaningful and practical. By this we mean that specifications must ensure quality unit performance and yet should not be written to improve unit performance at the sacrifice of total system performance.
2. What you can hear (or cannot hear) is what really counts.
3. Stress sound design and analysis in a basic unit. Where such analysis shows that conventional design is lacking and that audible improvement is possible, then investigate this gap and if possible, design circuits without these limitations that improve the current state of the art.
4. Design to avoid obsolescence by making a basic unit with plug-in circuit card construction. These plug-ins, since they are not built in, can be replaced with future state-of-the-art circuits when desired.
5. Maintain a reasonable price.
6. Keep it simple.

# BOSE 4401

An ultra-quiet preamplifier offering complete four channel discrete and matrix capabilities, with a signal processing flexibility that discriminating audiophiles and tape recording enthusiasts will appreciate.

## FOUR INDEPENDENT CHANNELS OF PREAMPLIFICATION.

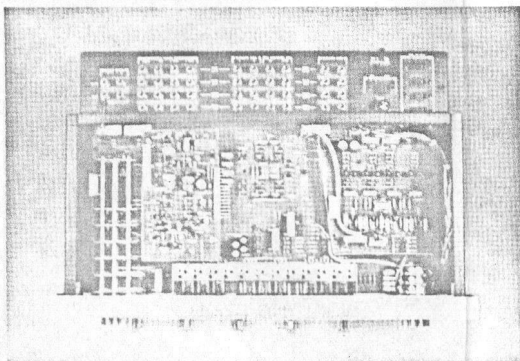
The 4401 offers four independent channels from input to output with the capability of matrix decoding, discrete four channel, or dual stereo operation. Signals from all current program sources, both stereo and quadriphonic, can be processed by the 4401.

## ULTRA-QUIET PHONO PREAMP CIRCUITRY.

The 4401 incorporates unique phono preamp circuitry that operates in an optimum manner when the phono input is connected to a magnetic cartridge rather than being short circuited (the traditional design specification criterion). This approach provides low-noise operation when it really counts - when a turntable system is connected to the preamp. In their quest for audible perfection, BOSE engineers developed a novel amplifier design using MET™ (Minimum Effective Temperature) circuitry that reduces the so-called "effective temperature" of the phono input network. The result is a corresponding reduction in noise which accounts for the ultra-quiet operation of the phono preamp circuitry.

## MODULAR CONSTRUCTION.

Circuitry for the SQ decoder and the CD-4 demodulator is contained completely on easily installed plug-in modules. The 4401 offers full protection against obsolescence since its basic four-channel circuitry easily can be adapted to



Top view of the 4401 (with cover removed) showing the layout of the P.C. construction and input/output connector panel.

future signal processing requirements that may be developed in the rapidly changing technology of quadriphonic sound. This will be accomplished simply by inserting new plug-in modules that incorporate these future developments.

## TAPE RECORDING FLEXIBILITY.

The tone control circuits, as well as the high and low cut filters, can be used to process a signal prior to recording, which provides an unprecedented degree of tape recording flexibility. Recordings can be made on two tape recorders simultaneously and tapes may be copied from either tape recorder to the other. Automatic internal switching maintains full use of all controls and functions during playback. A three-position tape monitor switch provides instant comparison between the program source and the output of either recorder.

## PROVISION FOR EXTERNAL EQUALIZERS.

Recognizing the increasing use of environmental equalizers and electronically equalized speaker systems, such as the BOSE 901®, the 4401 provides separate jacks for each of its four channels for the connection of external equalizers. An equalizer connected in this manner can be inserted or removed from the signal path by a separate front panel switch so that the tape monitor function is reserved strictly for recording purposes. A rear-channel bypass switch allows equalization of only the front channels without the use of jumper cables for the rear channels.

There are many additional features of the BOSE 4401 that distinguish it from conventional preamplifier designs:

- Separate left/right balance controls for both front and rear channels.
- Two auxiliary mode switch positions for increased program source flexibility.
- Precision tracking master volume control.
- Independent front and rear channel tone controls.
- Baxandall tone control circuits for optimum frequency contour control.
- Output amplifiers capable of driving both low and high impedance headphones.
- Time delay circuits for eliminating turn-on pops.
- Two-position phono capacitance switch for optimum matching to conventional or CD-4 phono cartridges.
- Optional SQ decoder and CD-4 demodulator plug-in modules.
- Full five-year warranty on parts and labor.

## SPECIFICATIONS:

### Input Sensitivity:

Phono 1: 2mv@1kHz  
Phono 2: 2mv@1kHz  
Tuner: 200mv  
Aux.: 200mv  
Tape 1: 200mv  
Tape 2: 200mv

### Rated Output:

2v RMS. Minimum 7v RMS before overload.

### Output Impedance:

600 ohms.

### Input Impedance:

High Level-100k ohms.  
Phono (except CD-4 mode) - 47k ohms.  
Phono (CD-4 mode) - 100k ohms.

### Frequency Response:

High Level-20-20,000Hz: ±0.2db.  
RIAA Phono - Equalization: ±1db.

### Distortion:

Harmonic Distortion ≤ 0.2%, 20-20,000Hz at rated output.  
IM Distortion ≤ 0.2% at rated output.

### Hum and Noise:

High Level: Minimum 80db below rated output. Noise typically 90db down.  
Phono: Within 8db of ideal noise-free amplification (A weighted).

### Low Filter:

-3db@70Hz, 6db per octave attenuation.

### High Filter:

-3db@7kHz, 12db per octave attenuation.

### Tone Control Range:

Bass - ±15db@50Hz  
Treble - ±15db@20kHz

### Volume Muting:

-20db.

### Power Requirements:

105-130vac or 210-260vac, 50-60Hz, 30 watts maximum.

### Dimensions:

6" high x 18" wide x 13 1/8" deep.

### Weight:

12 pounds.