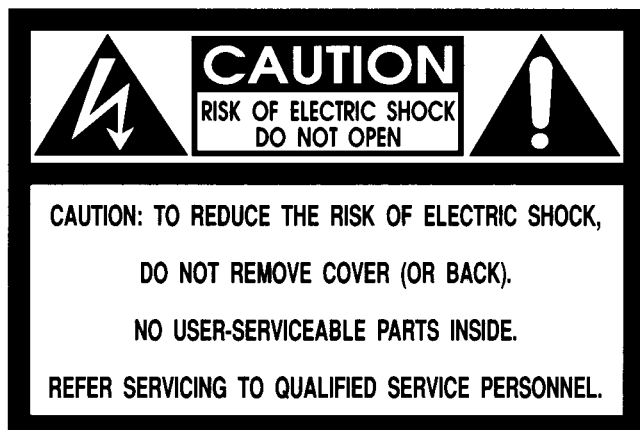




**MODEL 401
USER MANUAL**

5500 Bolsa Ave., Suite 245
Huntington Beach, CA 92649, (714) 897-6766
in USA (800) 233-8346, in CA (800) 558-3963

Important Safeguards



WARNING

To prevent fire or shock hazard, do not expose the unit to rain or moisture.

ATTENTION: RISQUE DE CHOC ELECTRIC- NE PAS OUVRIIR.



The lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.



The exclamation point, within a equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

For your protection, please read these safety instructions completely before operating the appliance, and keep this manual for future reference.

Carefully observe all warnings, precautions and instructions on the appliance and described in the operating instructions supplied with the appliance.

INSTALLATION

Water and Moisture - Do not install the appliance near water: for example, near a bathtub, washbowl, kitchen sink, laundry tub, in a wet basement, or near a swimming pool.

Heat - Do not install the appliance near sources of heat such as radiators, heat registers, stoves, or other appliances that produce heat.

Ventilation - Situate the product so its location or position does not interfere with its proper ventilation. For example, you should not place the product on a bed, sofa, rug, or similar surface that might block the vent openings, or placed in a built-in installation, such as a bookcase or cabinet that might impede the flow of air through the ventilation openings.

Wall or Ceiling Mounting - If your appliance can be mounted to a wall or ceiling, mount it only as recommended.

USE

Power Source - Connect the appliance to a power supply only of the type described in the operating instructions or as marked on the appliance.

Power-Cord Protection - Route the power cord so that it is not likely to be walked on or pinched by having objects placed on it, paying particular attention to the plugs, receptacles, and the point where the cord exits from the appliance.

Grounding or Polarization - Do not defeat the grounding or polarization feature of the AC power cord. If your AC receptacle will not accept the power cord plug, contact your electrician to install a proper AC receptacle.

When not in use - Unplug the power cord of the appliance from the outlet when left unused for a long period of time. To disconnect the cord, pull it out by grasping the plug. Never pull the plug out by the cord.

AC Receptacle - Check to make sure that the AC receptacle holds the power cord plug firmly and securely. If the power cord plug is loose, contact your electrician to replace the defective and unsafe AC

Foreign Objects - Be careful that foreign objects and liquids do not enter the enclosure through openings.

SERVICE

Unplug the appliance from the wall outlet and consult qualified service personnel when:

- the power cord or the plug has been damaged.
- a solid object or liquid has fallen into the cabinet.

- the appliance has been exposed to rain or moisture.
- the appliance does not appear to operate normally or exhibits a marked change in performance.
- the appliance has been dropped, or the enclosure damaged.

Do not attempt to service the appliance beyond that described in the operating instructions. For all other servicing, refer to qualified service personnel **only**.

Congratulations!

Thank you for buying the BBE Model 401 UNIMAX Processor. You now own a very unique signal processing device with no other equal in the audio world. Whether you purchased the BBE 401 for your home studio or club P.A. system, you will find the unit's rugged construction and careful electronic design a welcome addition to your audio system.

This manual will help you use the BBE 401 more effectively and in ways of which you may not be aware. Review of the information contained in this owner's manual will answer most of the common questions that our service department receives. But if you still have questions, please feel free to call toll-free (in USA) 1-800-233-8346 or (in CA) 1-800-558-3963.

The BBE™ Process — “What Is It?”

Loudspeakers have difficulty dealing with the electronic signals supplied by an amplifier. These difficulties cause such major phase and amplitude distortion that the sound reproduced by a speaker differs significantly from the sound produced by the original source.

In the past, these problems have proved unsolvable and were thus relegated to a position of secondary importance in audio system design. However, phase and amplitude integrity is essential to accurate sound reproduction. Research shows that the information which the listener translates into the recognizable characteristics of a live performance are intimately tied into the complex time and amplitude relationships between the fundamental and harmonic components of a given musical note or sound. These relationships define a sound's "sound".

When these complex relationships pass through a speaker, the proper order is lost. The higher frequencies are delayed. A lower order frequency may reach the listener's ear first or perhaps simultaneously with that of a higher frequency. In some cases, the fundamental components may be so time-shifted that they can reach the listener's ear ahead of some or all the harmonic components.

This change in the phase and amplitude relationship of the harmonic and fundamental frequencies is technically called "envelope distortion". The listener perceives this loss of sound integrity in the reproduced sound as "muddy" and "smeared". In the extreme, it can become difficult to tell the difference among musical instruments, for example, an oboe and a clarinet.

BBE Sound, Inc. conducted extensive studies of numerous speaker systems over a ten year period. With this knowledge it became possible to develop an ideal speaker and to distill the corrections necessary to return the fundamental and harmonic frequency structures to their correct order. While there are differences among various speaker designs in the magnitude of their needs for correction, the overall pattern of correction needed is remarkably consistent.

The BBE™ process is so unique that 42 patents have been awarded by the U.S. Patent Office.

“How It Works”

The BBE™ process imparts a pre-determined phase correction to the high frequencies where most harmonic information exists. This is done by breaking the signal into three sub-bands or groups: the low frequency group which is crossed over at 150Hz, the mid-range group which is crossed over at 1200Hz and the high frequency group that handles everything else up to 20kHz.

The low group is delayed about 2.5 ms (milliseconds) via group delay within a passive low pass filter. The front panel control allows for either a flat response or a boost of the lows at 50Hz.

The mid-range group is delayed only about 0.5 ms and passes through an active band-pass filter. The mid group is used as a point of reference to make dynamic amplitude corrections in both positive and negative directions to the high frequency group which has been passed through a high quality VCA (Voltage Controlled Amplifier).

Two RMS average loudness detectors continuously monitor both the mid-range and high frequencies to compare the relative harmonic content levels of the two bands and apply the appropriate amount of control voltage to the VCA, thereby determining the amount of high frequency harmonic content present at the final output of the BBE™ processor.

Product Description

The BBE 401 is an intelligent audio processor designed to solve a series of complex problems as described in the previous section. It is, however, very simple to set up and operate and once installed will function flawlessly without further attention.

It is a single-channel, rack-mountable device for use in applications such as those found in P.A. systems, home recordings studios, and commercial audio applications. Since the BBE 401 can handle both -10dBu line levels and high **or** low impedance microphone levels, it may be integrated into **any** existing audio system without costly, or-site system modifications. The BBE 401 takes up one EIA standard rack space of 19 inches width and 1.75 inches height (1U).

BBE™ applies different phase correction algorithms to three separate frequency bands. A variable front panel control allows the user to adjust the amount of process desired.

Using Your New BBE 401

BBE™ is a process to be added before all other mixing of reverb, special effects or equalization. The BBE 401 should be used to increase the clarity and intelligibility of the program material.

Unlike many aural exciters or equalizers, the BBE 401 will not add any extra noise or harmonics to the sound. Thus, there will be no future problems in duplication or mastering caused by aberrant high frequency distortion. Since the BBE™ technology is a single-stage process there is no need for encoding or decoding.

Always "A-B" the processed to unprocessed sound with the process in/out switch to adjust the amount of processing required.

Things To Remember

The BBE 401 has **three** sets of inputs and outputs to accommodate **any** existing audio system. Please consult the "Controls and Set-Up" section of the manual to determine which input and output connections are correct for your application. Proper operation of the BBE 401 depends on proper interfacing.

Even though there are Hi-Z inputs on both the front panel and the back panel, they **do not** mix. This means that if you plug a cable into Hi-Z jack #1 on the front panel, it will cancel out any program material coming into Hi-Z jack #2 on the rear panel. The front panel jack is provided as a convenience to the user.

If the program material has excessive background noise, the noise may be modulated with the program. In this case, an equalizer or other type of noise reduction system may be inserted in front of the BBE 401 to roll off the noise first. Post-amplification of the BBE 401 is not necessary and not recommended, as the BBE 401 will drive any microphone input or -10dBu line directly.

Applications

Various applications of the BBE™ process include:

Home Recording Studios

The BBE 401 gives a pro-edge to otherwise dull recordings on narrow-track width home recorders. Snare drums and guitars take on a brighter tonal quality without equalization. Tape tracks recorded without BBE™ can be processed after the fact by placing the BBE 401 between the tape track output and the mixer channel input. The BBE 401 saves poorly recorded low-level instruments and brightens them without bringing up tape hiss as equalizers do. The program transients are greatly improved on just about any sound source, because the BBE 401 reduces mid-range smear and associated masking effects.

The BBE 401 acts as an active "direct" box so that high impedance microphones, guitars, basses or synthesizers can be plugged directly into the mixer's low impedance input. Conversely, the BBE 401 matches a low impedance microphone to a high impedance input and provides the +24 volt phantom-power needed by condenser-type microphones. The BBE 401 is the perfect mic pre-amp for amplifying microphones to drive -10dBu line levels.

Figure 1 shows the BBE 401 installed between a low-impedance microphone and the low impedance input of the mixing console.

Figure 2 shows the BBE 401 installed between a line-out of the mixing console and the main program fader input. This arrangement would apply the BBE™ process to the entire program mix.

Figure 3 shows the BBE 401 used as an active direct-box for matching high impedance musical instruments to low impedance mixer inputs. The BBE™ process can be applied directly to the recording in this fashion.

Figure 4 shows the BBE 401 used as a mic pre-amp to bring a high impedance microphone up to -10dBu line level for direct recording on a home tape recorder.

Music and P.A. Systems

The BBE 401 has become a popular addition to many P.A. systems because it can make a drastic improvement to the clarity of the vocals without the usual excessive brightness associated with equalizers.

The BBE 401 is perfect for the traveling musician who wants to have BBE™ applied to the "house P.A." without disrupting the wiring installation. Figure 5 shows the BBE 401 inserted between the house microphone and the house mixer. This can be done by the musician quickly and removed after the show just as quickly. The BBE 401 does not harm or alter the settings on any existing system.

The BBE 401 is also perfect for podium sound systems since it can be added right at the podium itself without any internal modifications to the podium's amplifier. The BBE 401 allows better intelligibility with less volume. Figure 6 shows the BBE 401 in a typical podium installation.

The BBE 401 is the ideal unit for applying the BBE™ process in situations where the sound system has no other insert points or is permanently wired and cannot be modified. The BBE 401 also provides a universal method of matching **any** microphone to **any** sound system.

Industrial

The BBE 401 greatly improves intelligibility in speech and music by improving the attack of the consonants that the human ear needs in order to recognize the difference between like sounding words and syllables. This makes the BBE 401 a natural for public address, intercom or wide area dispersion of pre-recorded music or voice announcements over existing old and dull loudspeaker systems.

Figure 7 shows the BBE 401 inserted between the telephone matching adapter and the auxiliary input to the public address intercom amplifier. Since the BBE 401 has a microphone pre-amp, the BBE 401 is perfect for installation where the P.A. amplifier is inaccessible or prior installations have not allowed for future modifications to be carried out easily. Figure 8 shows the BBE 401 installed between the P.A. microphone and the P.A. amplifier.

The Controls

Operation of the BBE 401 is quite simple due to the sophisticated "smart" circuitry within the unit. Below are the names and purposes of each control on the BBE 401.

Front Panel

HI-Z In	Accepts high impedance microphones or other low level unbalanced devices with average outputs of -20dBu . Has priority over duplicated rear panel HI-Z In (MIC).
Gain	Controls the gain of the input stage. Starting from minimum, turn the control clockwise until you hear the same level established prior to inserting the BBE 401. (note: This control is inoperative when unit is in LINE mode.)
Lo Contour	Phase corrected bass equalization. This adjustment ranges from -10dBu (min) to $+10\text{dBu}$ (max) at 50Hz relative to the input. The middle position is flat or unity gain.
Definition	Set to minimum, yields a flat frequency response with phase correction only. Turning clockwise increases the amplitude of the high frequency band relative to the mid band amplitude and provides an improved spectral balance between the high band and the mid band.
HI-Contour LEDs	These three LEDs indicate the high band amplitude compensation. RED LED (marked "–"): Compression mode. The amplitude of the high band is too high as compared to the mid band and compression is being applied to compensate. AMBER LED (marked "0"): Flat mode. No compensation is needed. The program spectral content is correct. GREEN LED (marked "+"): Expand mode. The amplitude of the high band is too low as compared to the mid band and is being expanded to compensate.
Clip LED	This LED lights when the signal out of the BBE 401 is clipping. The gain control or input level into the unit must be reduced. (lit at $+16\text{dBu}$).
BBE™ LEDs	These two LEDs work in conjunction with the function switch. When the BBE™ process is being applied to the signal, the GREEN LED marked IN lights and when the AMBER LED marked OUT lights, the signal is not processed and is bypassed through the unit.
Function	This switch allows a quick comparison of processed with unprocessed sound. When the switch is in, the signal is being processed.
Power	This switch controls the primary power to the unit.

Rear Panel

AC Power Cord	Plugs into AC power receptacle.
Fuse	Turn cap on fuse holder counterclockwise to remove fuse. (Note: replace with 250Vac, 1/2 A type fuse).
HI-Z Out Line	This 1/4" phone jack is the high impedance unbalanced line output. This connects to the input of a power amplifier or a convenient insertion point of a mixer.
LO-Z Out	This 3-pin male XLR connector is the ballanced transformer output which normally goes to the point where a low impedance, ballanced, low level device was previously installed. (Typically a low impedance microphone).
LO-Z Balanced In	This 3-pin female XLR connector accepts ballanced, low impedance, low level devices with an average level of -40dBu . Phantom power ($+24\text{VDC}$) exists on pins 2 and 3 (pin 1 common). (Note: If phantom power is present at the LO-Z Out connector of the BBE 401 and is greater than the $+24\text{VDC}$ already present, it will be fed through to this connector enabling a condenser type microphone that requires more than $+24\text{VDC}$ to be used).
HI-Z In	This 1/4" phone jack accepts high impedance, low level, unbalanced devices with an average level of -20dBu . (Typically a high impedance microphone) (Note: Inserting a jack into the front panel connector marked HI-Z IN will disable this duplicate connector.)
Line In	This 1/4" phone jack accepts unbalanced, high impedance, line level devices with an average level of -10dBu (Note: This jack is after the input gain stage and when in operation, the gain control on the front panel is inoperative).

Specifications

Frequency Response	
Bypass	DC to 20kHz
Process Mode	program controlled
Noise in Process Mode	
gain control to maximum	- 85dBu
gain control to minimum	- 100dBu
Total Harmonic Distortion in Process Mode	less than 0.1% @ 1kHz @ - 10dBu, HI-Z IN
Input Characteristics	
Input Impedance	LINE Input: 47K ohms HI-Z Input: 470K ohms LO-Z Input: 1K ohms
Nominal Input Range	LINE Input: - 10dBu HI-Z Input: - 20dBu LO-Z Input: - 40dBu
Maximum Input Level	LINE Input: + 16dBu (input clip point)
Gain Control	
HI-Z IN to HI-Z OUT	Maximum: - 20dBu below input Minimum: + 10dBu above input
LO-Z IN to LO-Z OUT	Maximum: - 26dBu below input Minimum: + 4dBu above input
Lo Contour Control	
Maximum	+ 10dBu above input at 50Hz
Minimum	- 10dBu below input at 50Hz
(Note: middle position is flat)	
Phantom Power	
+ 24 volts DC on pins 2 and 3 of LO-Z IN connector; pin 1 is common.	
(Note: If Phantom Power exists at the LO-Z OUT connector of the BBE 401 and is greater than the + 24 volts DC already present at the LO-Z IN connector, it will automatically be fed through to the LO-Z IN connector allowing the use of a condenser microphone that requires larger voltage, typically + 48 volts DC.)	
Power Requirements	
120 VAC (nominal) 50/60 Hz 8 Watts (220 VAC available)	
A/C Line fused protected	
Dimensions	
1 3/4" H x 17" W x 5 3/4" D Standard 1U Single Rack	
Weight	
4 1/2 lbs. (2.5 Kgs)	
NOTE: OdBu = 0.775Vrms	

Calibration Procedure for the BBE™ Model 401

For serial numbers CXXXXX

Equipment Required:

1. DVM (digital voltmeter).
2. Signal source (audio frequencies, sine wave).
3. Low impedance, balanced source (input and output for LO-Z).

Initial Settings:

1. Definition control (VR3) to minimum.
2. LO CONTOUR (VR7), VR@ and VR5 to their middle positions.
3. GAIN (VR1) to maximum.
4. Function button IN and POWER on.

Procedure:

Power Supply Test:

1. With DVM set to DC volts measure pin – 4 of U2 relative to ground and the DVM should read $+12\text{Vdc} \pm 0.5\text{Vdc}$.
2. With DVM set to DC volts measure pin – 11 of U2 relative to ground and the DVM should read $-12\text{Vdc} \pm 0.5\text{Vdc}$.
3. With DVM set to DC volts measure pin – 2 and then pin – 3 relative to pin – 1 of the LO-Z BALANCED input. Both pins should read approximately $+24\text{Vdc}$.

Unity Adjustment:

1. Set signal source for 0dBu (.775Vrms) at 500Hz input to LINE IN.
2. Connect DVM (set for AC volts) to LINE OUT referenced to ground.
3. Adjust VR6 until DVM reads 0dBu (unity).
4. Change source to 5000Hz. Adjust VR5 until DVM reads 0dBu (unity).

Offset Adjustment:

1. Remove signal from LINE IN so no input signal exists.
2. Set DVM to DC volts and measure TP1 relative to ground.
3. Turn DEFINITION control until DVM reads -350mVdc .
4. Change source to 5000Hz. Adjust VR2 for a reading on the DVM of $+300\text{mVdc}$ ($\pm 5\text{mVdc}$). (Note: the DEFINITION control and VR2 interact so check the readings between the two frequency settings and make the necessary adjustments until both readings are correct.)

Gain Test:

1. Input a 100mVrms signal at 500Hz into the HI-Z IN connector.
2. Set DVM to AC volts and measure the LINE OUT connector.
3. You should read 4 to 5Vrms on the DVM.

Clip Adjustment:

1. Set source for $+16\text{dBu}$ (4.887Vrms) at 500Hz and input to LINE IN.
2. Adjust VR8 until the CLIP LED just turns on. Any lower level input should turn the LED off.

LO-Z BALANCED Connector Test:

1. Input a balanced signal at -30dBu (24.5Vrms) into the LO-Z BALANCED IN connector.
2. Measure the LO-Z BALANCED OUT connector with the DVM and adjust the GAIN control until you read the same as the input -30dBu . Or you should have half the input on each pin, i.e. 12.25mVrms on pin – 2 and pin – 3 relative to pin – 1 180 degrees out of phase.

Bypass Check:

1. Input a 0dBu, 500Hz signal into the LINE IN connector.
2. Connect DVM across the LINE OUT connector.
3. Push PROCESS button to the OUT position and insure DVM reads 0dBu ($\pm 0.5\text{dBu}$). In bypass you should have a flat frequency response from 10Hz to 20kHz.

LED Check:

1. Input a 0dBu, 500Hz signal into LINE IN.
2. Turn the DEFINITION control completely clockwise (maximum). The GREEN (+) LED should light.
3. Turn the DEFINITION control completely counterclockwise (minimum). The AMBER (0) LED should light.
4. Set source to 5000Hz (0dBu) and turn the DEFINITION control completely clockwise (maximum). The RED (–) LED should light.
5. Push the FUNCTION button IN, the corresponding GREEN (IN) LED should light.
6. Push the FUNCTION button to the OUT position and the corresponding AMBER (OUT) LED should light. These two LEDs should never be lit at the same time.

END TEST

Service

We recommend that if at all possible a BBE 401 which requires repair be sent to our facility in Huntington Beach, CA. We request that a "Return Authorization" be issued by the dealer from whom you purchased the unit. If this is not possible, call BBE Sound, Inc. directly to obtain a "Return Authorization" and include with the unit a copy of the bill of sale so that this process can be expedited.

As the repair turnaround time is minimal, we request that the unit be sent to BBE Sound, Inc. We also need to add reliability data to our files so that future revisions may be undertaken if necessary to improve the product.

Warranty

The BBE 401 Processor is warranted against defects in material and workmanship for a period of one (1) year from date of purchase from BBE Sound, Inc. or from an authorized dealer.

During this period, we will repair units free of charge providing that they are shipped pre-paid to BBE Sound, Inc., 5500 Bolsa Ave., Suite 245, Huntington Beach, CA 92649. We will pay return UPS shipping charges within the U.S.A. All charges related to non-U.S. shipping, including customs clearance, will be billed.

This warranty will be considered null and void by BBE Sound, Inc. if any of the following is found:

1. Equipment has been physically damaged.
2. Equipment shows sign of abuse.
3. The equipment has been electrically damaged by improper connection or attempted repair by the customer or a third party.
4. The equipment has been modified without authorization.
5. The bill of sale indicates that the purchase date of the equipment is not within the warranty period.

BBE Sound, Inc. is NOT LIABLE FOR CONSEQUENTIAL DAMAGES. Should the processor fail to operate for any reason, our sole obligation is to repair the unit as described above.

Maintenance

Maintenance of the BBE 401 is limited to proper cleaning of the unit with mild household cleaner such as Formula 409™ or Windex™. The chassis and cover are steel finished with a durable polyurethane paint, while the front panel is an anodized aluminum extrusion.

There are no user replaceable parts and the unit should not be opened for any reason unless you are a qualified technician.

Calibration should be performed if parts are replaced or if a performance check-out indicates a problem with calibration. Long term use has shown that over the life of this unit there is little or no drift of the components in the BBE 401 which would cause a change in calibration. A very conservative design philosophy has resulted in a piece of equipment which runs very cool and should give years of trouble-free service.

FIGURE 1
LOW IMPEDENCE MICROPHONE APPLICATION

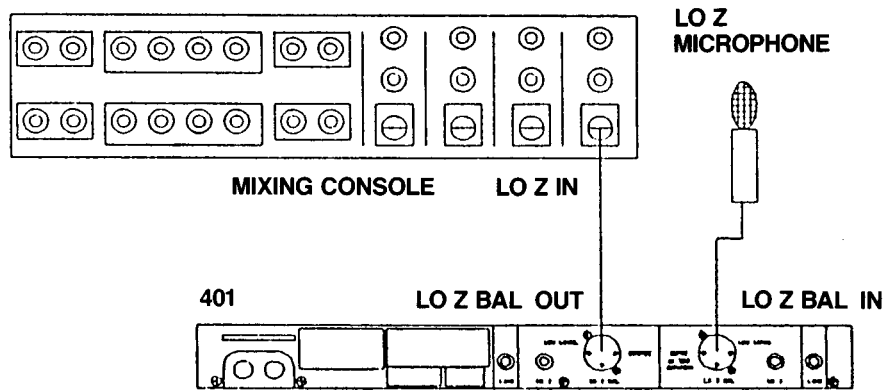


FIGURE 2
BBE PROCESS ON ENTIRE MIX

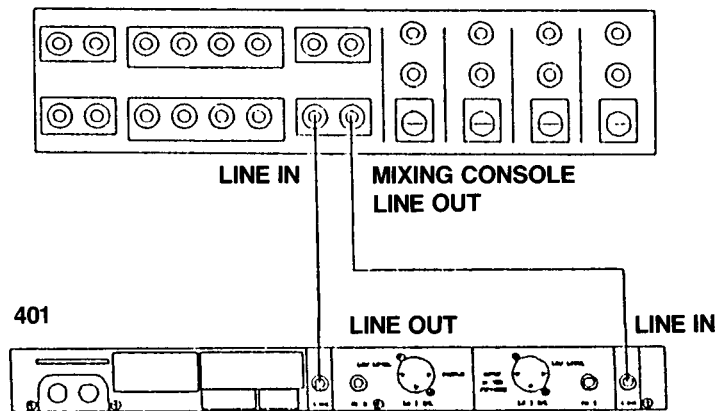


FIGURE 3
DIRECT BOX APPLICATION

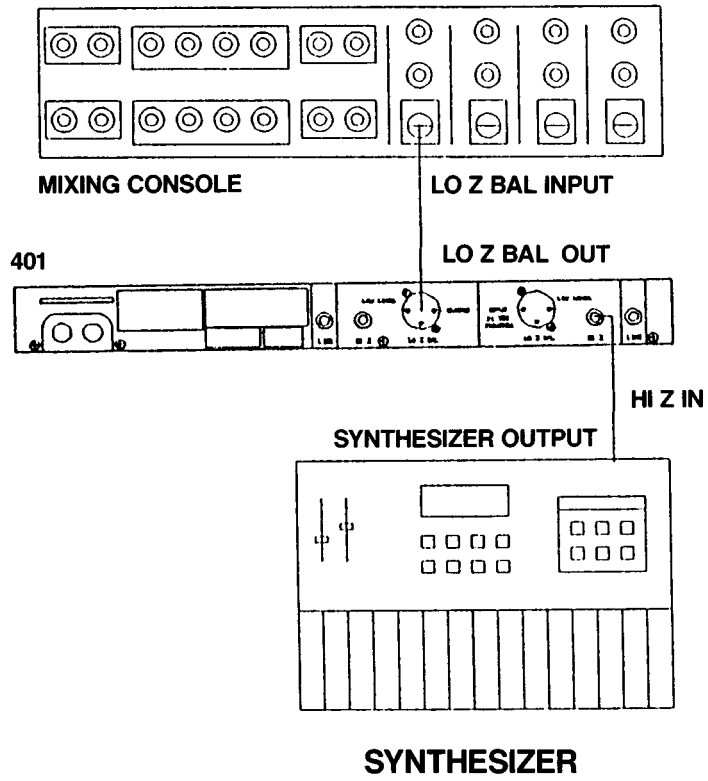


FIGURE 4
MICROPHONE PRE-AMP APPLICATION

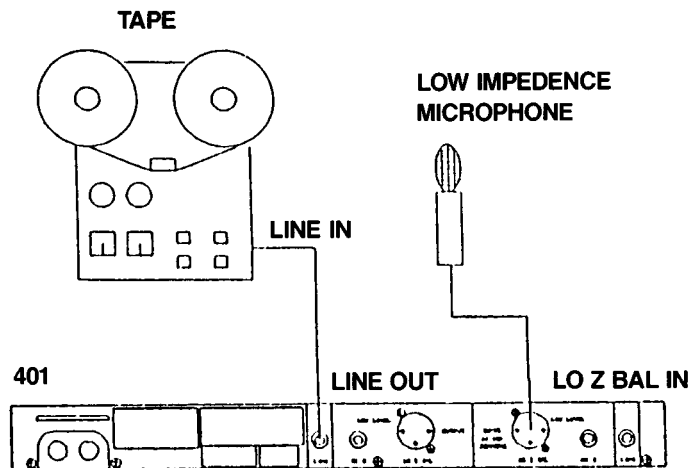


FIGURE 5

INSERTING A 401 IN A HOUSE SYSTEM

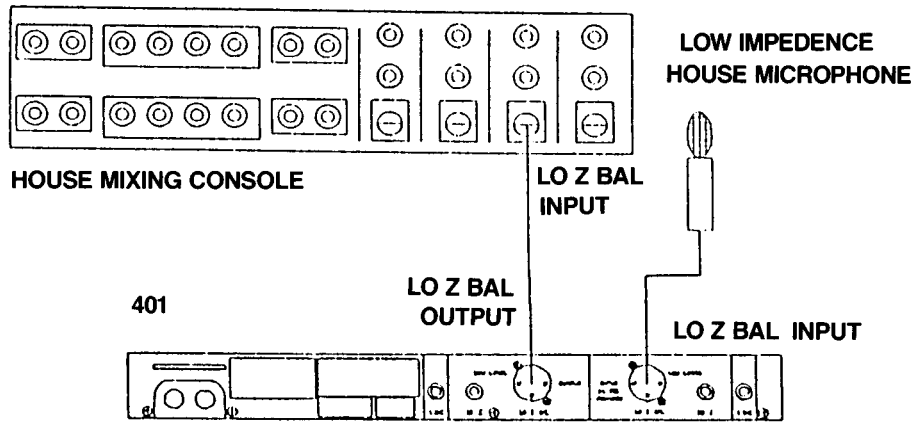


FIGURE 6

PODIUM SOUND SYSTEMS APPLICATION

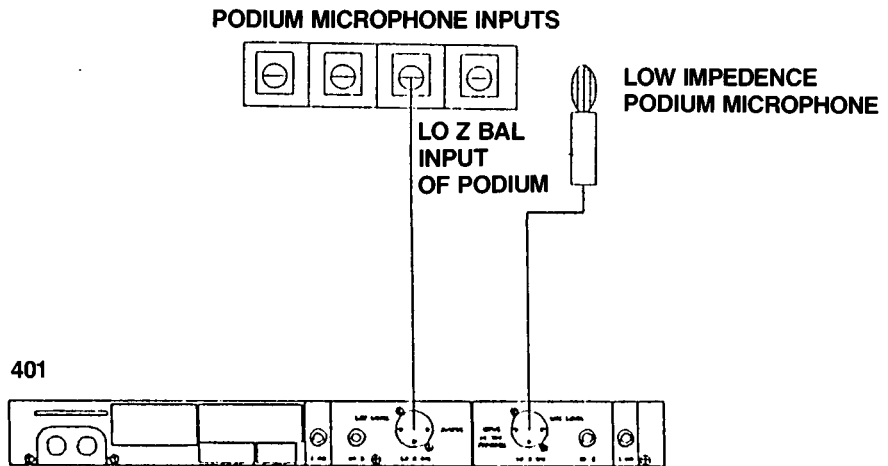


FIGURE 7
INDUSTRIAL P.A. APPLICATION

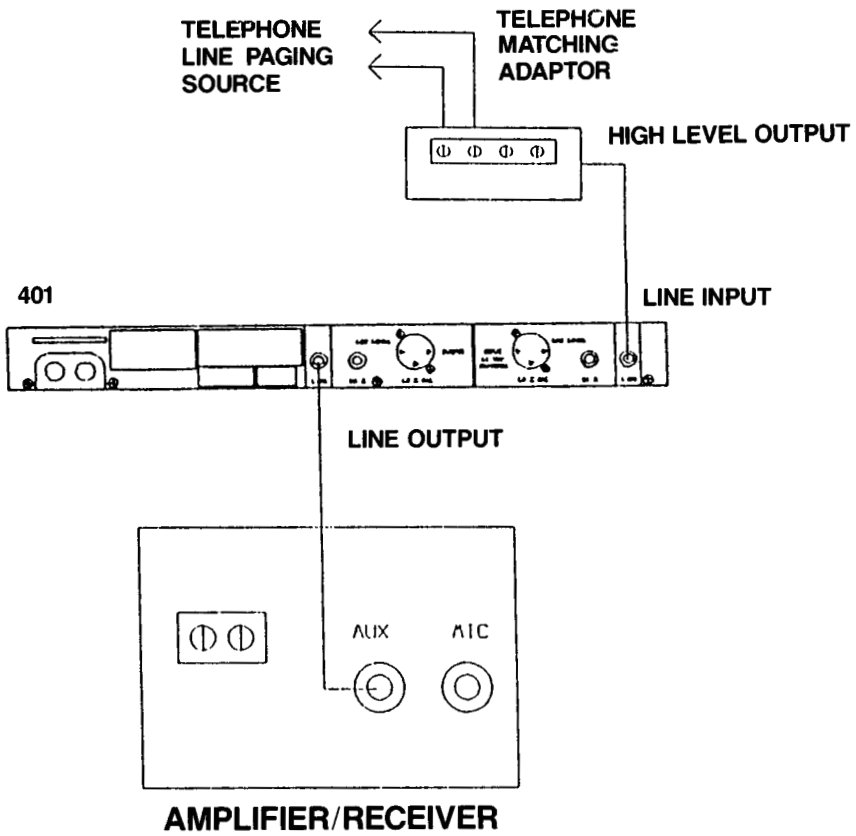
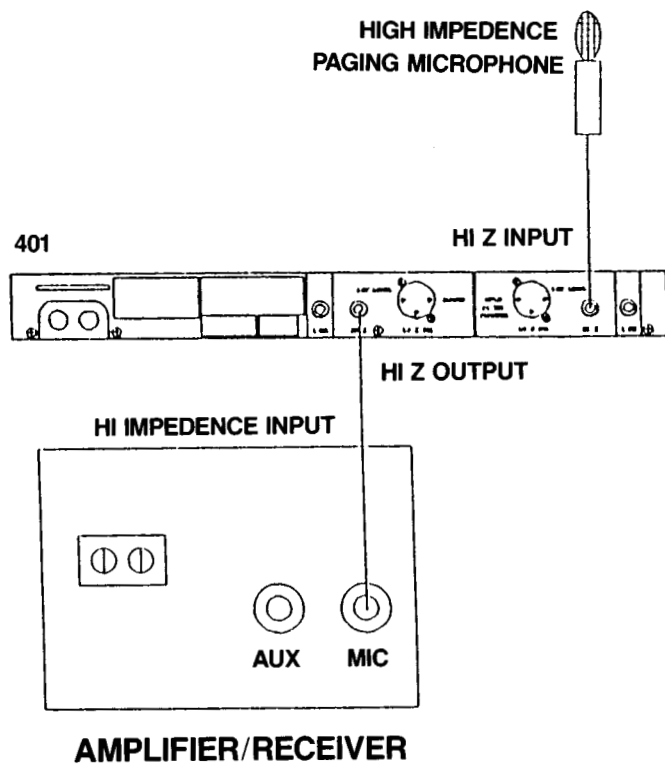
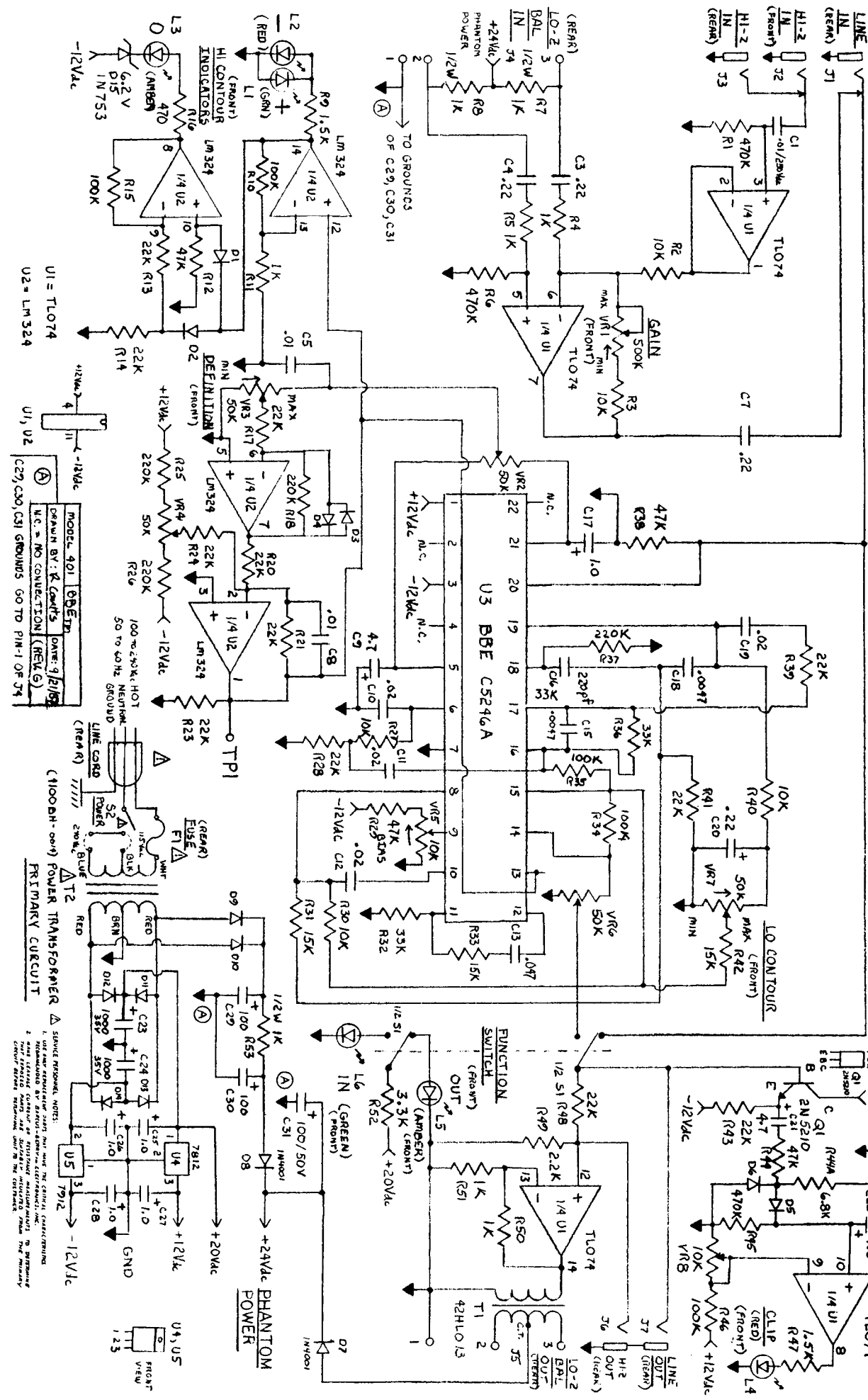


FIGURE 8
INDUSTRIAL P.A. APPLICATION
USING MICROPHONE DIRECTLY



ALL RESISTORS IN OHMS
 ALL CAPACITORS IN MICRO FARADS UNLESS OTHERWISE MARKED
 UNMARKED DIODES MEANS PARTS ARE ON OUTSIDE OF UNIT (FRONT OR REAR)



MODEL 901 BBE™
 DRAWN BY: K. CARROLLS DATE: 9/21/83
 N.C. = NO CONNECTION (RELG.)

U1 = TLO74
 U2 = LM324

100-0-250VAC HOT
 50 TO 40 Hz GROUND

SEPARATE PHANTOM POWER TRANSFORMER
 (110000-000) POWER TRANSFORMER
 PRIMARY CIRCUIT

SEPARATE PHANTOM POWER TRANSFORMER
 (110000-000) POWER TRANSFORMER
 PRIMARY CIRCUIT

U4, U5
 FRONT VIEW