

# HUSH 2000

## INSTRUCTION MANUAL

### ATTENTION

DO NOT ATTEMPT TO USE YOUR HUSH 2000  
WITHOUT FIRST READING THIS MANUAL, OR  
YOUR NEW UNIT MAY SEEM TO NOT BE WORKING  
PROPERLY.

U.S. Patents #4647876, 4696044  
Other patents pending.  
Foreign patents pending.

**RSP**  
Technologies

RSP Technologies is a division of  
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## **INTRODUCTION**

The HUSH 2000™ is a professional single-ended noise reduction unit. This unit utilizes RSP's newest VCA and RMS detection controlled noise reduction technology. The HUSH 2000, with two dynamically controlled low pass filters for mid and high band, and a separate release time for each band, provides the ultimate noise reduction for all applications. The HUSH 2000 incorporates a low level expander that can also be used as a noise gate, and is the only answer to all your noise problems. The special design of the HUSH 2000 allows use with instruments (guitars, keyboards, etc.) to reduce circuit noise from all noisy effects, including flangers, distortion units, phasers, chorus units, digital delays, compressors, parametric equalizers, Rockman, pedal board devices, analog delays, psychoacoustic enhancement devices, pitch shifting devices, harmonizing devices as well as countless applications in broadcast, professional recording and live sound reinforcement systems. Use the HUSH 2000 for cleaning up studio tracks, tape duplications, motion picture sound, mix down recording, intercoms, phone lines, and more.

This operating manual will introduce you to the HUSH 2000 and its various functions. After reading this manual carefully, keep it for future reference.

### **ATTENTION:**

**If you begin without reading this manual, your new HUSH 2000 may seem to not be working properly.**

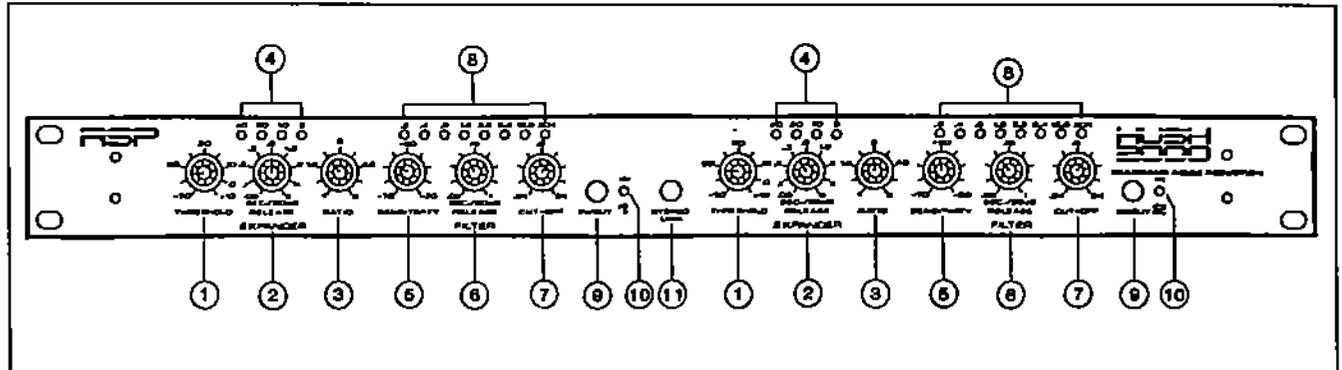
NOTE: If using the stereo link switch, it is recommended that all controls are set identical to ensure proper tracking.

NOTE: With the ratio control set maximum and the expander control set at +10, an input signal level would have to exceed approximately +5dBv to produce an output signal.

REFER TO THE MANUAL FOR PROPER APPLICATION SETTINGS.

## FRONT PANEL DESCRIPTION

The HUSH 2000 has two identical channels. Each channel is divided into two sections with the following controls as well as individual channel in/out switches and a stereo link switch for stereo tracking.



### **CHANNELS ONE AND TWO**

#### **EXPANDER SECTION**

(1) . . . THRESHOLD CONTROL: Variable between -70 and +10dB

The threshold control sets the threshold point at which low level downward expansion takes place once the signal level drops below the set threshold. Once the signal is below the threshold, the amount of expansion increases as the signal level decreases.

(2) . . . RELEASE CONTROL: Variable between 0.05 and 6 sec./20dB

The release control allows the user to adjust the desired length of release time.

(3) . . . RATIO CONTROL: Variable between 1:1 and 6:1

(4) . . . EXPANDER METER: 4 LEDs

This four segment meter indicates -40, -20, -10 or -3dB of expansion taking place.

#### **FILTER SECTION**

(5) . . . SENSITIVITY CONTROL: Variable between -70 and -30dB

The sensitivity control sets the point at which the dynamic filters operate relative to the input signal level.

(6) . . . RELEASE CONTROL: Variable between 0.06 and 1 sec./20dB

The release control adjusts the high band release time while the low band tracks it by a pre-determined fixed ratio.

(7) . . . CUT-OFF CONTROL: Variable between 200Hz and 6KHz

The cut-off control allows the user to adjust the filter -3dB point for various noise conditions.

(8) . . FILTER METER: 8 LEDs

This eight segment meter indicates the bandwidth of the filter as being 0.2, 0.4, 0.8, 1.6, 3.2, 6.4, 12.8, or 30KHz.

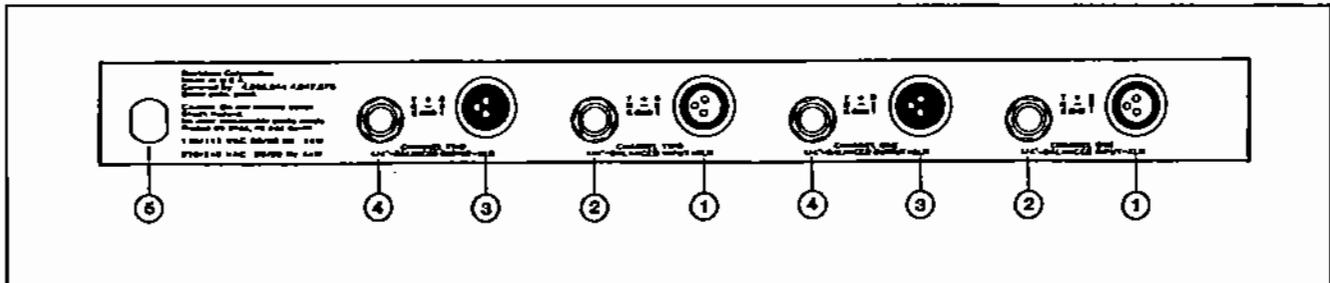
(9) . . CHANNEL IN/OUT SWITCH

(10) . . CHANNEL IN LED

(11) . . STEREO LINK SWITCH:

The stereo link switch allows the two channels to track each other while allowing independently programmable release rates and expansion ratios to be used. Both the expander and filter detection circuits are linked together for stereo applications.

## REAR PANEL DESCRIPTION



### CHANNELS ONE AND TWO

(1) . . CHANNEL XLR BALANCED INPUT JACKS

(2) . . CHANNEL 1/4" BALANCED INPUT JACKS: (tip: +, ring: -, sleeve: gnd)

(3) . . CHANNEL XLR BALANCED OUTPUT JACKS

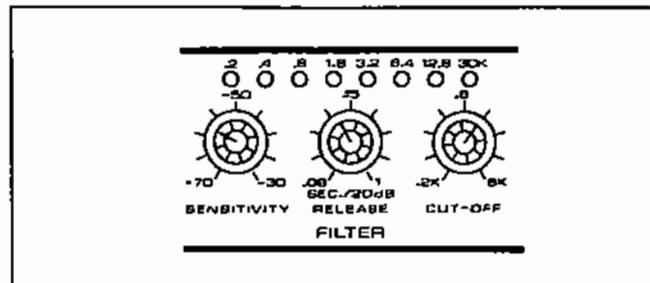
(4) . . CHANNEL 1/4" BALANCED OUTPUT JACKS: (tip: +, ring: -, sleeve: gnd)

(5) . . AC POWER CORD

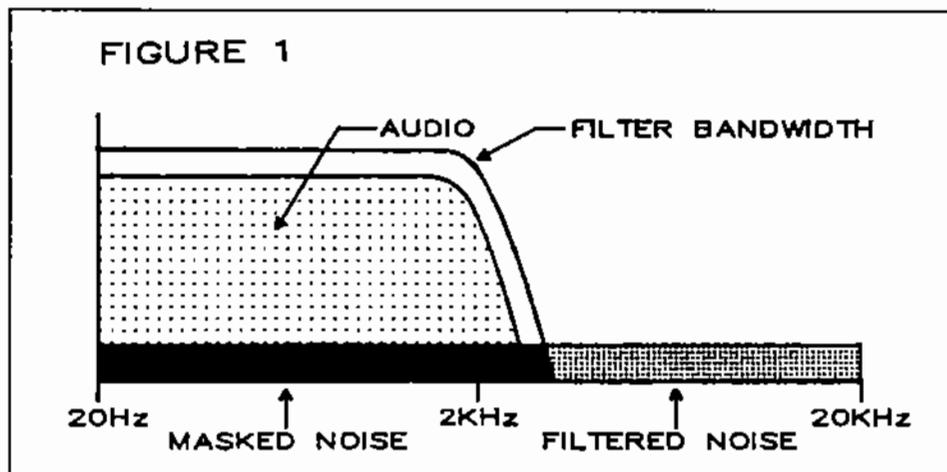
## OPERATIONS

Each channel of the HUSH 2000 is comprised of two separate circuit sections. To maximize the performance of this product, it is necessary to understand what is taking place in each of the separate circuit sections individually first and then how they perform together. By understanding what these circuits are doing, it will be easier to set up the controls correctly to suit any application. The two individual circuit sections are the EXPANDER section and the FILTER section. The expander section performs only when signal levels are weak or low. The filter section, on the other hand, performs its noise reduction process at all times. Since the filter section is always active, let's look at what is happening in that circuit first.

### FILTER SECTION



The filter section uses dynamic low pass filtering in which an electronically controlled low pass filter is employed and operates as follows. In the absence of any audio signal, the dynamic filter will close down to a user selectable cut-off point. This cut-off point is variable between 200Hz and 6KHz. If the cut-off was set for 200Hz, the bandwidth of the filter would be from 20Hz to 200Hz. If an input signal had a bandwidth from 20Hz to 1KHz, the filter would open far enough to pass up to the 1KHz frequency and its harmonics, while reducing any noise present from approximately 2KHz to 20KHz (see figure 1).



If a broad-band signal, with frequency components up to 20KHz appears at the input, the dynamic filter would open all the way to 40KHz. In simple terms, what this means is that if a signal appears at the input which is primarily bass components, the dynamic filter will reduce any mid or high-band noise, eliminating any possible breathing side effect. However, if the input signal has high frequency components present, the dynamic filter will open to its full extreme to pass the signal and eliminate the possibility of a loss of high frequency response.

The setting of the three controls in this section, the sensitivity, release, and cut-off controls, will be determined by the noise problem encountered or for the particular application.

## CUT-OFF

Under most conditions, the cut-off control should be set at 200Hz, allowing for the maximum possible amount of noise reduction by the dynamic filtering section. Only in remote conditions where it is desirable to only effect the noise in the upper portion of a signal (i.e. 2KHz-4KHz) should another frequency be selected. For example, if it is desirable to only eliminate noise in the upper frequency range, from 2K-20KHz, adjust the filter cut-off control for 2KHz. Note: the dynamic filter will have no effect on the noise between 200Hz to 2KHz in this application.

## RELEASE

To correctly adjust the filter release control, it is suggested that on individual instruments, or vocal signals, faster release rates be used. This is because there is no real ambiance to the signal. Release times on the order of 0.06 to 0.15 sec. would be normal. However, with processed signals, or composite music, a slower release time should be utilized. Release times slightly greater than 0.15 sec. are generally ideal. Avoid using very long release rates in this application to reduce the possibility of audible breathing side-effects. Using longer release rates such as 1 sec. allows the HUSH 2000 to be used to quiet reverb returns or other ambiance processing devices.

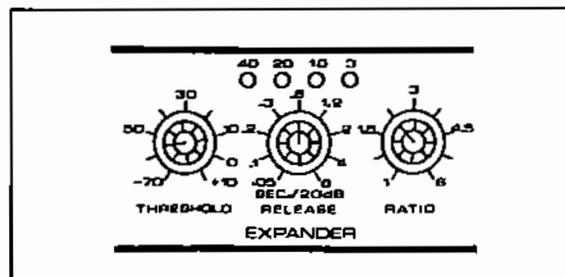
## SENSITIVITY

The sensitivity control setting will determine the point at which the dynamic filter opens from its quiescent pre-set cut-off point relative to the input signal level. What this means is that with the sensitivity control set at -70dB, an input signal containing high frequency information just slightly above -70dBv will cause the filter to open. Setting the sensitivity control too far above the noise floor of the signal encountered will result in a subsequent loss of high frequencies. Therefore careful selection of the sensitivity control is required.

## METER

The metering above the dynamic filter section (8 LEDs) indicates the bandwidth of the filter itself. If no LEDs light, the filter cut-off is at 200Hz. If all the LEDs light, the subsequent bandwidth of the dynamic filter is greater than 30KHz and the filter would have no effect on the signal. In most applications, adjusting the sensitivity of the filter to where the noise floor only causes the first LED to come on, is generally an appropriate setting.

## EXPANDER SECTION



The expander section of the HUSH 2000 provides downward expansion based on the settings of the expander controls on the front panel. Let's examine the function of these expander controls.

## THRESHOLD

The threshold control determines the point at which downward expansion begins and is variable between +10dBv to -70dBv. For example, if the threshold control was set at 0 dBv and

if the input signal drops below 0 dBv, downward expansion will begin.

In typical applications, the setting of the threshold control should be between 5-20dB above the quiescent noise floor of the input signal. For example, if the quiescent noise floor was -60dBv, a setting between -40 to -55dBv will produce the desired expansion.

## RELEASE

The release control determines the time required for the downward expander to decrease the level of the output signal. The release control is variable from 0.05sec (50msec) to 6sec for 20dB of gain change. The ultimate setting of the release control will be based on the desired response of the expander section. When using the expander sections for gating applications, settings between 0.05-0.2 are recommended. The expander section can also be used for soft downward low-level expansion, or very quick gating effects. For individual instruments, or vocals, use a setting between 0.2-0.6 sec. For composite music, a setting between 0.6-2 sec is recommended. To use the expander section to reduce subtle background noise from ambient devices such as reverb chambers, a very slow release time on the order of 2-6 sec is ideal.

## RATIO

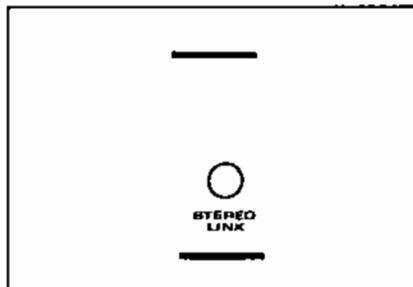
The ratio control determines the ultimate expander ratio when the signal level drops below the pre-set threshold point, and is variable between 1:1 and 6:1. At 1:1, the expander circuit is effectively by-passed. At 6:1, it can be understood that if the input level were to drop by 1dB, the ultimate expansion would be 6dB. The expander section of the HUSH 2000 incorporates soft-knee expansion which means as the input level drops slightly below the threshold point the expander ratio will start at 1.1:1 and increase to an ultimate ratio selected by the front control. Once again the setting of the ratio control is based on the desired response of the expander section. Settings between 0.15-4.5 are recommended for downward expansion applications and ratios from 4.5-6 are recommended for gating applications.

## METER

A 4 LED meter located above the expander controls provides a visual indication of the expansion taking place in decibels.

Note: with the ratio control set maximum and the expander control set at +10, an input signal level would have to exceed approximately +5dBv to produce an output signal. One final note about the expander section is that when in the stereo link mode, the expander sections detection circuits of channel 1 and 2 are tied together. The setting of one channel's threshold will effect the threshold of the other channel. What this means is that a weak or small input signal level would produce no output from the expander circuit if either of the channels expander thresholds are set excessively.

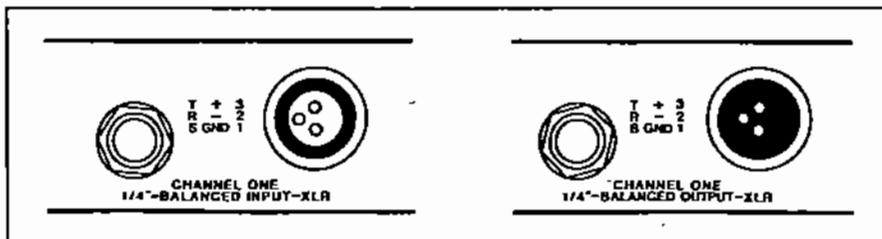
## STEREO LINK



Switching in the stereo link switch will tie channel 1 and channel 2 together at each channel's expander detection circuits and also at each channel's filter detection circuits. Although this allows the two channels to track each other for stereo applications, it should be understood that this is not

a master/slave set up, but rather a link and for true stereo tracking it is necessary to set both channel's controls identical. When using the stereo link, a high level, high frequency signal present in one channel will cause the expander and filter of both channels to open at the exact same point. It is then desired that both channel's expanders and filters close at the same point. Therefore it is recommended that both channels be set identically. (The most critical controls are the expander threshold and the filter sensitivity controls.) If the two channels are not set identically, a predominate setting in one channel will effect the other channel. The only two controls that operate separately when the stereo link switch is in are the expander release and the expander ratio. It is still recommended to set these controls the same on both channels. However, if one channel has more noise than the other, the expander release/ratio controls can be set to close one channel's expander slightly quicker for greater noise reduction while still tracking in stereo.

## INPUT AND OUTPUT SECTIONS



For each channel of the HUSH 2000, there are 2 connections provided on the back panel for each input, and output. Each is provided with standard 1/4" connector (where tip: +, ring: -, and sleeve: ground), and a balanced XLR connector (where 3: +, 2: -, and 1: ground). Simply shorting the - pin to ground will unbalance the input, if an unbalanced input is desirable. The balanced output circuit provided in the HUSH 2000 will automatically sense if the output is connected to an unbalanced source and will produce full output level. No internal switching is required for balanced or unbalanced connections. Grounding either output pins (+ or -) will produce full output level at the opposite output pin.

## OPERATING THE EXPANDER AND FILTER IN CONJUNCTION

The subsequent setting of the front panel controls will be based on the input signal level and noise floor. Due to the fact that it would be impossible to demonstrate every application for the HUSH 2000, careful reading of this manual and the functions of its controls is recommended.

The following is one such typical set-up and can be used as a guide for other applications.

### EXAMPLE:

*type of music:* composite  
*reference level:* -10  
*noise floor:* -60  
HUSH 2000 control settings  
expander section  
*threshold:* -50  
*release:* 2 sec  
*ratio:* 4.5  
filter section  
*sensitivity:* -60  
*release:* .15  
*cut-off:* .2

## SPECIFICATIONS

### INPUT

Max. Input Level: +21dB  
Input Impedance: 20K Ohms  
Input Jacks: 1/4" Stereo

### DYNAMIC RANGE

Greater than 110dB

### EFFECTIVE NOISE REDUCTION

Greater than 50dB

### TOTAL HARMONIC DISTORTION

Less than .08% @1KHz

### FILTERS

Voltage controlled state variable low pass

Filter Cut-Off: Variable 200Hz to 6KHz  
Filter Dynamic Bandwidth: program dependent 200Hz to 50KHz  
Filter Attack Time: Less than 1ms  
Filter Release Time: High Band Variable 50ms/20dB to 1sec/20dB  
Filter Sensitivity: Variable -70dBv to -30dBv

### FREQUENCY RESPONSE

+/- .5dB 20Hz to 20KHz

### EXPANDER

Threshold: Variable -70dB to +10dB  
Release: Variable 50ms/20dB to 6sec/20dB  
Ratio: Variable 1:1 to 6:1

### OUTPUT

Max. Output Level: +21dBv  
Output Impedance: 120 Ohms  
Output Jacks: 1/4" Stereo

### DIMENSIONS

19" x 1 3/4" x 6"

## **MAINTENANCE**

This unit is designed to provide years of trouble-free service but requires careful handling. To maintain this unit in proper working condition read the Safety Instructions. If any problem is encountered do not return the unit to your dealer. RSP Technologies will accept full responsibility for all warranty repairs.

## **WARRANTY**

All parts and workmanship of this RSP Technologies product are fully guaranteed to be free of defects under normal use and service for a period of TWO years from date of purchase.

The warranty will remain in effect until the original expiration date, regardless of whether or not the product is re-sold in the interim.

It is not required that you fill out a form for warranty registration. We would however, recommend that the dated proof of purchase be retained throughout the warranty period.

Any damage resulting from mis-use or failure to follow instructions and precautions as stated in the product manual will void this warranty.

Should this RSP Technologies product require repair, RSP Technologies will assume responsibility for repair service. **Do not return the product to the Dealer.** Simply repack the unit, along with a description of the problem, to: RSP Technologies, 2870 Technology Drive, Rochester Hills, Mi 48309. All shipping charges must be fully prepaid.

This warranty is void if the original Serial Number has been altered or removed, or if this unit has been altered in any way.

RSP Technologies reserves the right to make changes in design and/or improvements upon their products without any obligation to include those changes in any products previously manufactured.

