intellipitch™

INTELLIGENT PITCH SHIFTER

With Pitch Processing By: WaveMechanics™

USER'S MANUAL

ROCKTRON CORPORATION

CE

Your Intellipitch™ has been tested and complies with the following Standards and Directives as set forth by the European Union:

Council Directive(s):	89/336/EEC	Electromagnetic Compatibility
Standard(s):	EN55013, EN50082-1	

This means that this product has been designed to meet stringent guidelines on how much RF energy it can emit, and that it should be immune from other sources of interference when properly used. Improper use of this equipment could result in increased RF emissions, which may or may not interfere with other electronic products.

To insure against this possibility, always use good shielded cables for all audio input and output connections. Also, bundle audio cables separately from the AC power cables. These steps will help insure compliance with the Directive(s).

For more information about other Rocktron products, please see your local dealer or one of our importers closest to you (listed on the enclosed warranty sheet).

Contents

1. Introduction

Congratulations on your purchase of the Rocktron Intellipitch™!

The Intellipitch is a 24-bit, MIDI-programmable digital effects processor featuring intelligent, chromatic and reverse pitch shifting algorithms. In addition, the Intellipitch also provides a host of other effects, including 8-voice stereo chorusing, three different digital delay algorithms, unsurpassed digital reverb quality and highly flexible configuration programming (allowing for simultaneous operation of up to 5 effects with complete mixing capabilities). The unit also offers a fully digital implementation of patented HUSH® noise reduction at the unit's input, as well as ducking capabilities for the delay and reverb effects.

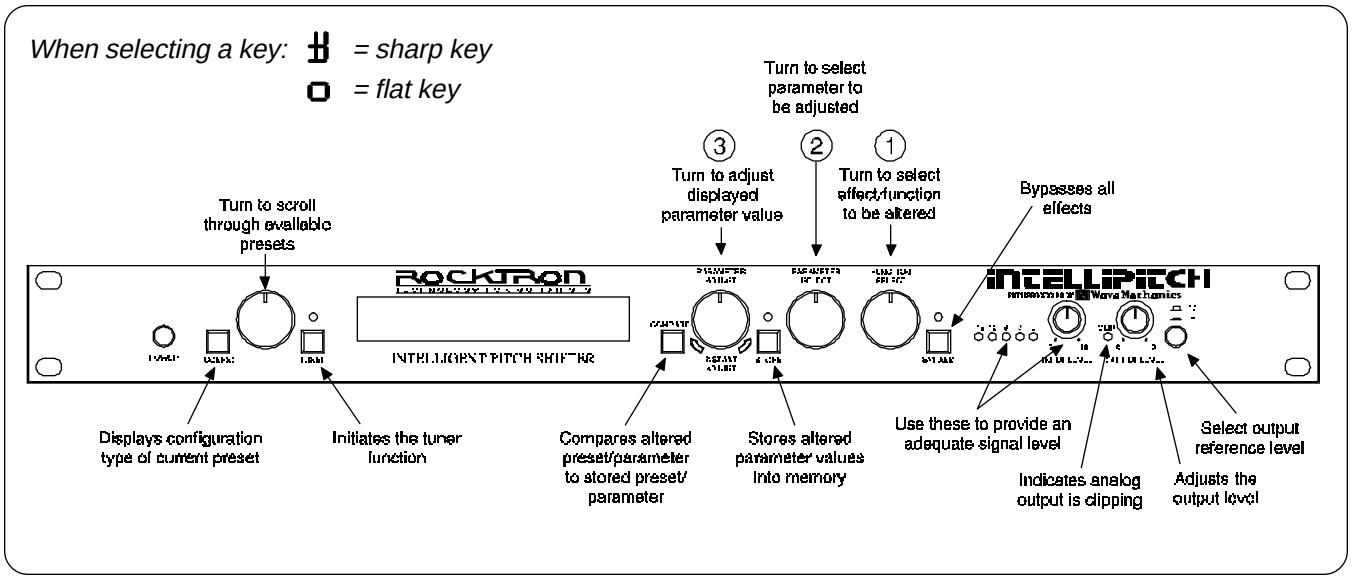
The Intellipitch utilizes three individual 16-bit converters and Sigma-Delta A/D conversion, achieving a 64x oversampling rate and better than 100dB dynamic range for superb sonic quality.

A good understanding of how the Intellipitch operates will help make designing your own preset sounds much easier. This manual will introduce you to the Intellipitch and its various features and functions. Please keep it for future reference.

Intellipitch Features

- *High quality pitch shifting algorithms, including:*
  - ** 2-voice intelligent pitch shifting over 2 full octaves*
  - ** 4-voice chromatic pitch shifting over 3 full octaves*
  - ** 2-voice pitch shifting offered simultaneously with HUSH®, delay and reverb*
  - ** 2-voice reverse chromatic pitch shifting*
- *8-voice chorusing with an enormous number of parameters for the richest chorus ever*
- *Super quiet operation through the use of high quality 16-bit converters and digital HUSH*
- *High purity sound due to the use of a 64X oversampling A/D converter, which samples the signal 64 times as often as a conventional converter, and also due to the use of a separate dual D/A converter. (Most "bargain" digital effects units use a single converter multiplexed 3 ways, resulting in decidedly higher distortion and lower dynamic range.)*
- *24-bit processing and memory circuits to maintain maximum dynamic range*
- *Ability to store up to 8 unique MIDI controller patches with each preset*
- *Very high quality effects algorithms*
- *Highly stereo effects with panning available on almost all signals*
- *Built-in tuner*
- *Programming via knobs instead of push buttons*
- *Easy to read, wide viewing angle display*

2. Quick Setup



Recalling an Intellipitch Preset

STEP 1 To recall a stored Intellipitch preset, turn the PRESET control to the desired preset number you wish to recall. The displayed preset will be recalled automatically.

14 PRESET TITLE

Changing Preset Parameters

STEP 1 The parameter menu for each effect can be called up via the FUNCTION SELECT control. Turn this control to the effect to be changed.

****** REVERB ******

STEP 2 Turn the PARAMETER SELECT control to select the parameter to be modified.

REV DECAY 59

STEP 3 Use the PARAMETER ADJUST control to modify the parameter value. The LED above the STORE button lights to indicate that a parameter value has been modified from the stored preset.

REV DECAY 32

STEP 4 The COMPARE button may be used to compare the stored value to the new one.

REV DECAY 59

Storing Modified Parameter Values

STEP 1 To store modified parameter values, press the STORE button while viewing a parameter or effect title to begin the store procedure. The Intellipitch will alternate displaying the current preset number/title and:

STORE TO PRESET

STEP 2 Turn the PRESET control to select the desired preset number to store the new parameter values into (if the new values are to be stored into the current preset location, this step is not necessary). User presets may be stored in preset locations 1-80. Presets 81-160 are factory presets and cannot be copied over. The Intellipitch will now alternate displaying the new preset number/title and:

STORE TO PRESET

STEP 3 Now press the STORE button a second time to store the modified values into the selected preset location. The Intellipitch will display "STORED" briefly before displaying the new preset number/title.

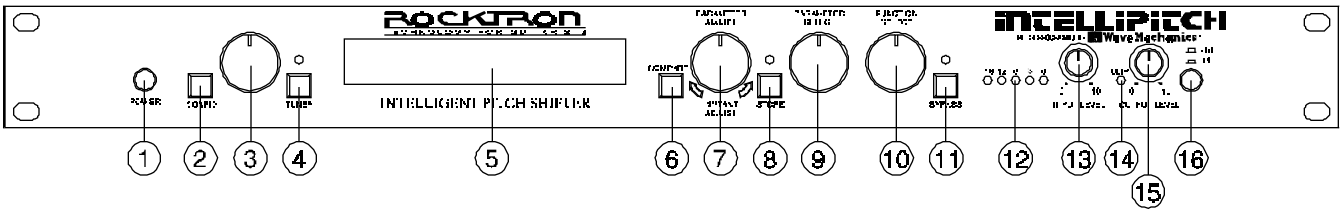
STORED

STEP 4 After the modified parameters have been stored into a new preset location, the Intellipitch will display "COPY TITLE TOO?". This occurs only when a new preset location is selected to store the modified parameters into, and allows for the title from the original preset to be copied to the new preset location as well. To copy the title, press the STORE button a third time. The display will again flash "STORED".

Note 1 *Turn either the PRESET or FUNCTION SELECT control to exit the store procedure without copying the title from the original preset.*

Note 2 *If a modified preset is exited without completing the store procedure (i.e. "STORED" displayed at least one time), all edited parameter values will be lost and the preset will revert to its original condition the next time it is recalled. When saving altered parameters, always make sure the Intellipitch flashes "STORED" at least once before exiting the preset to ensure that the desired modifications were stored into memory.*

3. Front Panel



Some of the controls on the Intellipitch front panel have more than one function, dependent upon the mode that the unit is currently operating in. Please read this section to become familiar with these functions.

1 POWER switch

2 CONFIG button

The CONFIG button is used to display the configuration type of the currently recalled preset. The configuration display indicates the effects that the preset executes as well as the order in which they are executed.

3 PRESET control

The PRESET control is used to scroll through the successive user presets and titles stored in its memory.

4 TUNER button

The TUNER button is used to initiate a tuner function that is built into the Intellipitch. Pressing the TUNER button a second time recalls the previous preset.

5 DISPLAY panel

6 COMPARE button

The COMPARE button may be used to compare a modified parameter value to its stored value. (Note: When comparing an altered value to a stored value, turning a knob or pressing a button that changes the value while the stored value is displayed will cancel the previously modified value.)

The COMPARE button may also be used to simultaneously compare multiple modified parameters under the same effect heading (i.e. Reverb, Mixer, etc.) to the stored values. To do so, turn to the effect heading where the modified parameters are located and press the COMPARE button. When the STORE LED is off, the stored parameter values are currently active. When the STORE LED is lit, the modifed values are active.

If a knob is turned or a button is pressed which changes the effect heading when the stored parameters are active (STORE LED off), any modified parameter values under that heading will be lost. This is also true if a MIDI control change is received while the stored parameters are active.

7 PARAMETER ADJUST control

This control is used to adjust the displayed parameter value. When the parameter is changed from its original value, the LED above the STORE button will light until either (a) the new value is stored, (b) a new preset is selected or (c) the parameter is returned to its original value.

8 STORE button

This button is used to store values into the Intellipitch memory when modified. See Chapter 8, section C, *"Storing Modified Parameters"* for more information.

9 PARAMETER SELECT control

When monitoring parameter values, this control will scroll through the available parameters under the current effect heading.

In the "TITLE EDlT" function, this control will scroll through the available characters in the title that may be edited.

10 FUNCTION SELECT control

This control allows access to each of the primary functions of the Intellipitch. Once a specific function has been selected, the parameters for the function are accessible through the PARAMETER SELECT control. Depending upon which configuration the current preset is created from, these functions may include:

Mixer	*HUSH*	*Reverb*	*Delay*
Ducker	*Voice/Delay*	*Intelligent Shift*	*Reverse Shift*
Title Edit	*Controller Assign*	*Program Mapping*	*MIDI Channel*
Factory Restore	*MIDI Dump/Load*	*Tuner*	*Config Select*

11 BYPASS button

When pressed, the LED is lit and all effects are bypassed.

12 INPUT LEVEL meter

These LEDs provide visual indication of the peak level of the input signal. For the optimal signal-to-noise ratio, it is best to adjust the input level so that the last LED (0dB) is rarely lit. This will guard against the possibility of overdriving the unit.

13 INPUT LEVEL control

This control adjusts the unit's gain to match the signal level at the input of the Intellipitch. The gain can be adjusted from -12dB to +12dB. Use the INPUT LEVEL meter to determine the setting of this control.

14 CLIP L.E.D.

When lit, this L.E.D. indicates that the final analog output is being overdriven because the Effects Level, Direct level, and Output Level control are set too high. If this occurs, reduce these levels until this L.E.D. does not light.

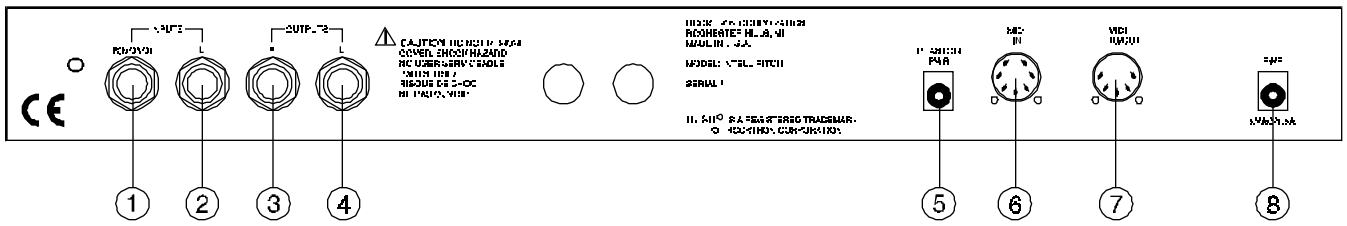
15 OUTPUT LEVEL control

This control is used to adjust the output level of the unit and may be adjusted from zero signal to a small amount of gain.

16 REFERENCE LEVEL switch

This switch determines the output range of the unit and may be set at either -10dB or +4dB. When using professional studio equipment providing a nominal input level of +4dB, it is recommended that the +4 setting on the Intellipitch be used for best results. If connecting the Intellipitch to a high sensitivity input, such as the input to a guitar amp, the -10 setting should be used.

4. Rear Panel



1 R (MONO) INPUT jack

This standard 1/4" mono jack provides input to the right channel of the Intellipitch. When using only one input (mono), this jack should be used.

2 L INPUT jack

This standard 1/4" mono jack provides input to the left channel of the Intellipitch. When using only one input, this jack should *not* be used.

3 R OUTPUT jack

This standard 1/4" mono jack provides an output for the right channel of the Intellipitch. When using the unit in a mono application, either output jack may be used.

4 L CHANNEL OUTPUT jack

This standard 1/4" mono jack provides output for the left channel of the Intellipitch. When using the unit in a mono application, either output jack may be used.

Note: When using a mono input (Right INPUT jack) and a mono output (either the Left or Right OUTPUT jack), the left and right effected signals are summed at the single output.

5 PHANTOM POWER jack

This jack provides the ability to power the Rocktron MIDI Mate™ foot controller from a seven pin MIDI cable which connects from the MIDI Mate to the MIDI IN jack on the rear panel of the Intellipitch, thus eliminating the need to find an AC outlet near where the footpedal would be placed during a performance—or the need to run an extension cord out to the MIDI Mate.

Instead of inserting the adaptor into the MIDI Mate POWER jack, plug it into the PHANTOM POWER jack on the Intellipitch. This will power the MIDI Mate through pins 6 and 7 of the MIDI cable connecting the two units. A 7-pin MIDI cable must be used for this feature and is available through your Rocktron dealer.

6 MIDI IN jack

This 7-pin DIN connector receives MIDI information from the device which is transmitting the MIDI commands for the Intellipitch to execute.

7 MIDI OUT/THRU jack

This standard 5-pin DIN connector passes on the MIDI information that is received at the MIDI IN jack to other MlDI-compatible devices via a MIDI cable. It also outputs MIDI data when performing a memory dump.

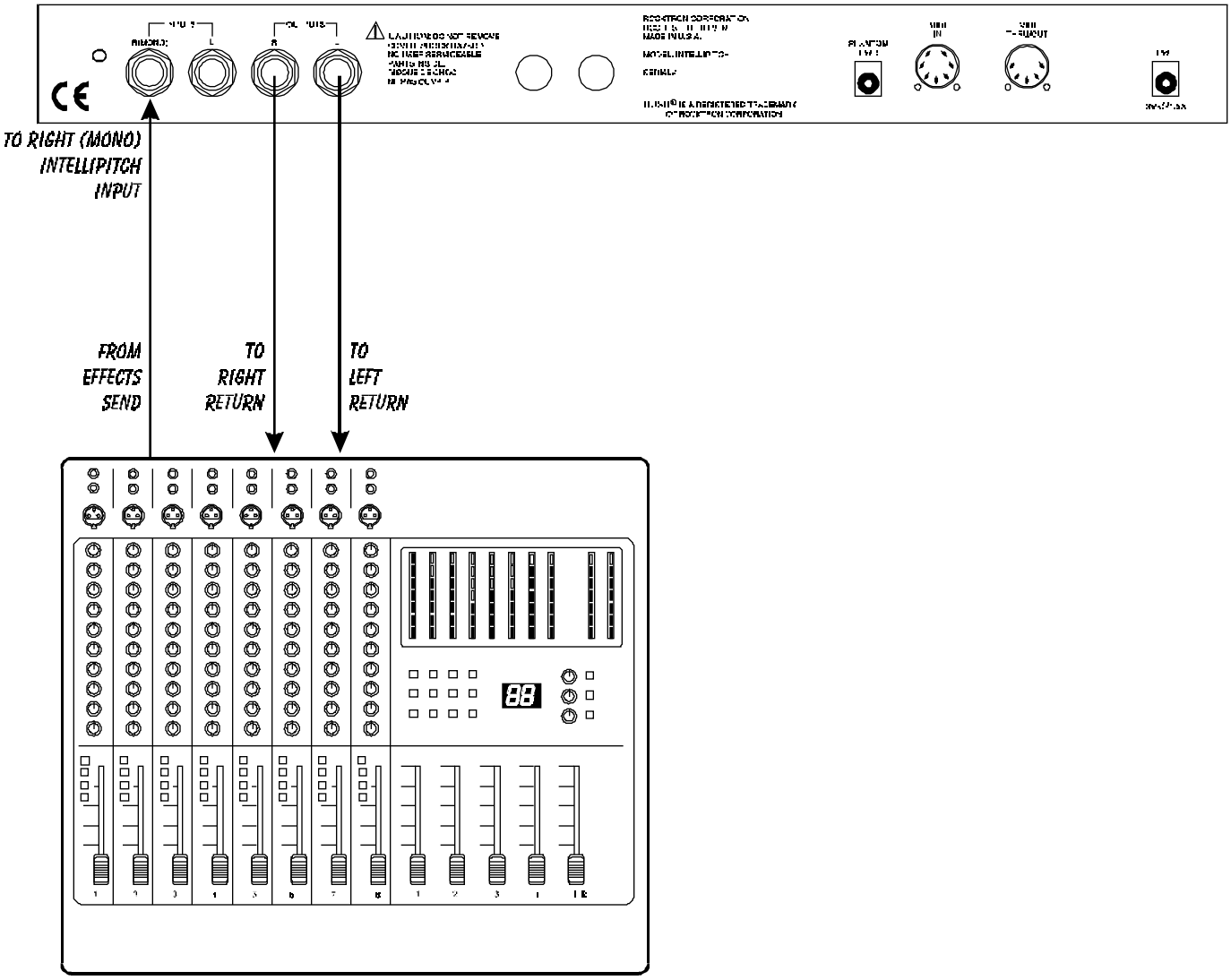
Note: Inherently in MIDI there is a limit to the number of devices which can be chained together (series connected). With more than three devices, a slight distortion of the MIDI signal can occur (due to signal degradation) which can cause an error in MIDI signal transmission. Should this problem arise, a MIDI box can be used which connects directly to the MIDI device which transmits MIDI information and has multiple connectors for the multiple devices receiving MIDI. MIDI cables should not exceed 50 feet (15 meters) in length.

8 POWER jack

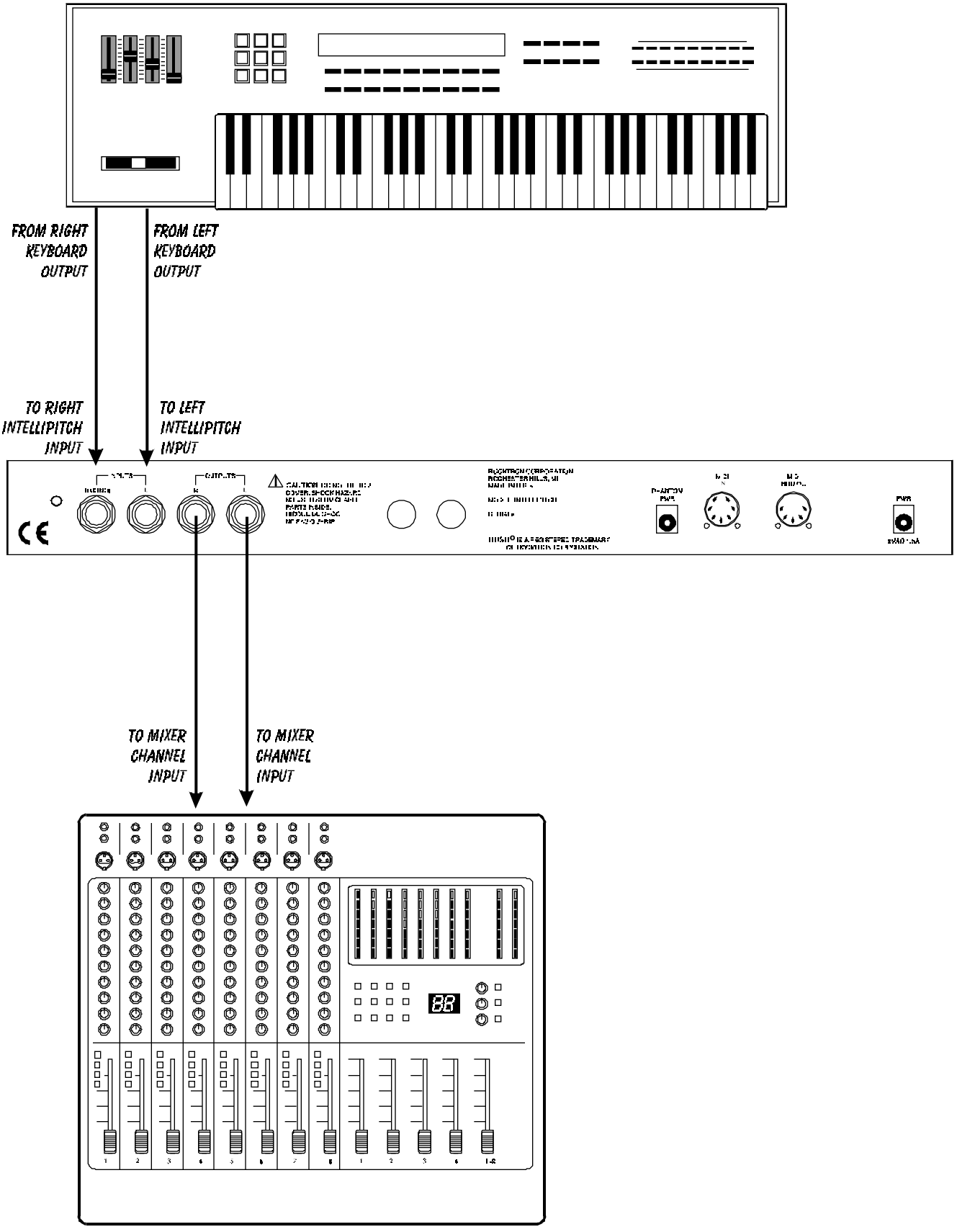
This jack accepts power from the 9VAC/1500mA adaptor supplied with the unit. For more information on the power supply see the *Power Requirements* section on page 2.

5. Connections

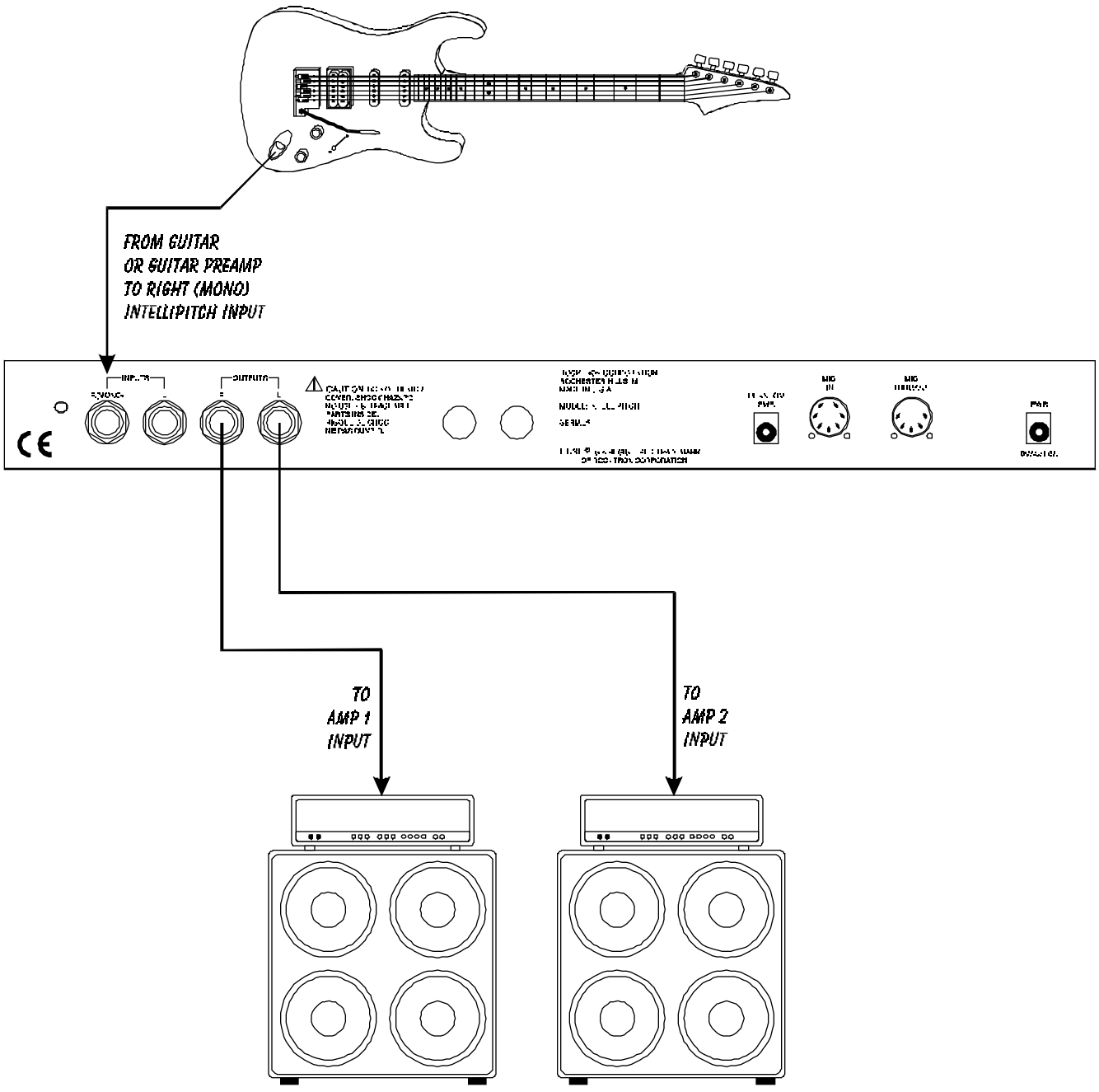
Using the Intellipitch with the auxiliary sends and returns of a mixer



Using the Intellipitch with a keyboard and mixer



Using the Intellipitch with a guitar and amplifier



!! CAUTION !! *Never connect the outputs of a power amplifier or guitar amplifier to the inputs of the Intellipitch. This could damage the Intellipitch.*

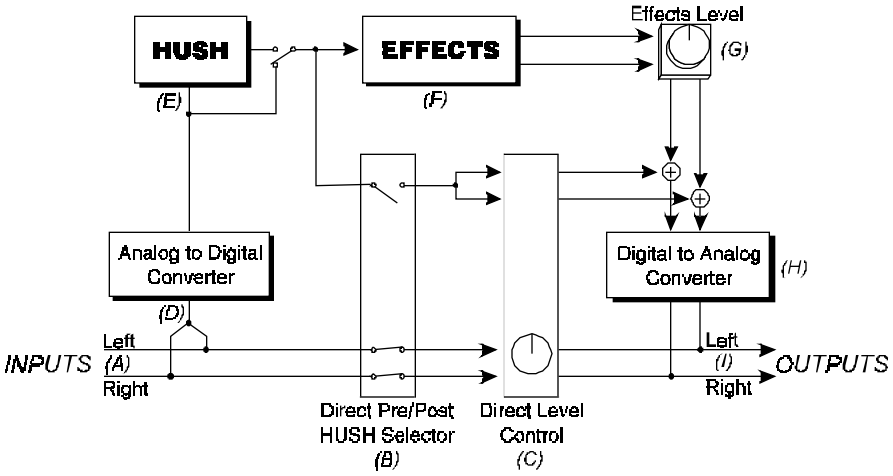
***Note**: For best results when using the Intellipitch with high gain distortion, always put the Intellipitch **after** the distortion in the signal chain, never before it.*

6. Principle of Operation

The Intellipitch provides many parameters to achieve the widest variety of preset sounds possible. The parameters available for a given configuration are divided into sections accessible via the FUNCTION SELECT control. This section will discuss each of the functions that are available which relate to a preset's overall sound. Utility-based functions, such as MIDI operation, title editing, and factory preset restoration, are described in Chapters 8 and 9.

MIXER Function

The first function accessible when turning the FUNCTION SELECT control in any preset is the *Mixer* function. This digital mixer allows you to control the signal levels pertaining to each preset's configuration and stores these levels for each preset.



Caution: Digital Output overload

As the input signal enters at the unit's input (A), the unaltered direct signal is fed to the Direct Pre/Post HUSH Selector (B). Here you may choose for the direct signal to remain unaltered (Pre) or feed it through the digital HUSH section (E) of the Intellipitch (Post). Before being fed to the HUSH section, the signal must first be converted from an analog signal to digital via the converter (D). When the direct signal is fed to the HUSH section, it will remain digital until it is summed together with the output of the Effects Level control (G).

It is important to remember that it is possible to overload the Digital-to-Analog Converter (H) if the effects levels and direct signal level are set too high when using the HUSH section with the direct signal. If this occurs, reduce these levels until the front panel CLIP L.E.D. does not light.

Also note that when passing the direct signal through the digital HUSH (Post), a stereo signal will be converted to mono.

Mixer Parameters

EFFECT LVL — This controls the level of the entire effect signal. This control should be set relative to the levels of the Left and Right Direct signals. In configurations which do not include a master Effects Level, the single effect level parameter (Chorus Level, Delay Level, etc.) is considered the master Effect Level control.

L/R DIR LEVEL — These controls allow for the left and right direct signal levels to be set individually, thereby allowing for panning of the direct signal to the left or right output. These controls are available in all configurations.

DIRECT HUSH — This determines whether the direct signal is fed through the digital HUSH section of the Intellipitch, or bypasses it. Selecting "Post" will pass the direct signal through the HUSH system while selecting "Pre" will bypass this section. *(Note: Selecting "Post" will convert a stereo direct signal to mono.)*

CHORUS LVL, DELAY LVL, REVERB LVL, etc. — In configurations which include a *Master Effects Level* control, these control the level of each individual effect (i.e., chorus, reverb, etc.). These should be set relative to each other when defining individual levels. In configurations which do not include a master Effects Level control, the individual effect level acts as a master effect level.

REGEN L/R — Configurations which include chorus or delay effects provide individual left and right regeneration level controls to determine the number of times the delayed signals are repeated. Regeneration is achieved by feeding the delayed output back into the input. Higher levels of regeneration will result in more repeats.

The Intellipitch features *Regeneration Limiting.* This feature guards against the possibility of overloading the processor when using high regeneration levels in configurations where a combination of multiple voices is panned to the left or right. If the regeneration level is set too high, the Intellipitch triggers the Regeneration Limiting and a limit is internally set for the regeneration. This limit can not be exceeded by increasing the *Regen L* or *Regen R* parameter values in the Mixer section.

If, for example, in the *Hush; Chorus; Delay; Reverb* configuration, Voice 1 is panned to the left and the *Regen L* parameter is set to its maximum level, panning a second voice to the left regeneration loop will trigger the Regeneration Limiter and reduce the regeneration to a level such that runaway regeneration will not occur. The original regeneration level can be reset only by recalling the preset, or, by accessing the *Regen L* parameter, decreasing its value and setting it back to its original value after removing the second voice from the regeneration loop. This feature of the Intellipitch is particularly desirable in live situations where panning and regeneration levels may be controlled by continuous controllers.

HUSH® Function

HUSH® is Rocktron's patented single-ended noise reduction system. The HUSH system contained in the Intellipitch is a fully digital implementation of HUSH achieved through Digital Signal Processing (DSP), and is modeled after the latest HUSH design.

The low level expander of the HUSH system operates like an electronic volume control. The analog design utilizes a voltage-controlled amplifier (VCA) circuit which can control the gain between the input and output from unity to 30, 40 or even 50dB of gain reduction. When the input signal is above the user preset threshold point, the VCA circuit is at unity gain. This means that the amplitude of the output signal will be equal to that of the input signal. As the input signal amplitude drops below the user preset threshold point, downward expansion begins. At this point the expander operates like an electronic volume control and gradually begins to decrease the output signal level relative to the input signal level. For example, if the input signal were to drop below the threshold point by 2dB, the output would drop approximately 3dB. As the input signal drops further below the threshold point, downward expansion increases. For example, if the input signal dropped 6dB below the threshold point, the output level would drop by approximately 14dB. A drop in the input level by 20dB would cause the output level to drop by approximately 54dB (i.e. 34dB of gain reduction). In the absence of any input signal, the expander will reduce the gain such that the noise floor becomes inaudible.

HUSH® Parameters

HUSH I/O — This parameter simply determines whether the HUSH circuit will be in the signal path or bypassed.

EXP THRESH — The Expander Threshold parameter determines the level at which downward expansion begins. For example, if the expander threshold was set at -20dB and the input signal dropped below -20dB, downward expansion would begin. Typically, this parameter should be set between 5-20dB above the quiescent noise floor of the input signal (i.e. if the noise floor was -60dB, a setting between -40 and -55dB will produce the proper expansion).

REL RATE — The Release Rate parameter determines the amount of time required for the downward expander to decrease the level of the output signal. This rate is adjustable from 25mS to 800mS to accommodate a wide variety of applications. For example, when using the expander for gating applications on drums, a very quick release rate (25-200mS) should be used. When used with individual instruments such as guitar, a setting of 200mS or higher will provide adequate expansion without being as harsh as a gate. When used with sources which have long decay times (cymbals, etc.) a very slow release rate should be used.

REVERB Function

Reverb, or reverberation, is the continuance of sound within a given room or enclosed chamber after the source of the sound has stopped producing it. More specifically, it is a multitude of echoes so densely spaced that, to the human ear, seem as a single continuous sound. These echoes gradually decrease in intensity until they are ultimately absorbed by the boundaries and obstacles within the room or enclosure. As the sound waves from the signal source strike the walls or boundaries of the room, a portion of the energy is reflected away from the obstacle and another portion is absorbed into it, thereby causing both the continuance of sound and the decaying or "dying out" of the sound.

Reverb Types

The Intellipitch *HUSH; REVERB* configuration offers 8 different reverb types: *Plate A*, *Plate B*, *Room A*, *Room B*, *Hall A*, *Hall B*, *Stadium* and *Dual*.

The **Plate** reverb type simulates an artificial method of producing reverberation, popular in the early years of recording, which involved using a fairly large, but very thin, metal plate suspended at its four corners by steel wires under tension. This metal plate becomes excited by a driver unit (similar to a dynamic speaker without the diaphragm) and the resulting reverberation is picked up by contact microphones.
The Intellipitch offers two Plate reverb types which reflect the most common plate characteristics. This type of reverb is often used on drum and vocal tracks.

Room reverb effects simulate various rooms of different sizes and surfaces. For example, a room which is made up of primarily hardened surfaces (such as tile or hard wood) will generate reflections containing much more high frequency information than one which is made up of softer surfaces (such as thick carpeting). The Room reverb effects offered by the Intellipitch can generate virtually any imaginable room setting via highly efficient and adjustable reverb parameters.

Hall reverb simulates the reverberation characteristics of a very large room with a high ceiling. Reflections in a hall are much longer than a typical room, as the length of time it takes for the sound waves to travel from one surface to the next is greatly increased.

Stadium reverb simulates the characteristics of a large stadium or arena and should be used with large amounts of predelay and high frequency damping.

Dual reverb is unique in that it allows for the left and right channels to be processed independently one another. For example, the Predelay for the left channel can be set at 100mS while the Predelay for the right channel can be set at 200mS. This results in reverb output from the left channel 100mS before reverb is output from the right channel.

Reverb Parameters

REV INPUT This parameter determines whether the input to the Reverb section is *active* (passing a signal) or *muted* (not passing a signal).

REVERB LVL This parameter determines the level of the reverb signal at the output relative to the Direct signal and any other effect signals. It is accessible from both the Mixer function and Reverb function parameter lists.

REV DECAY This parameter specifies the length of time that the reverb signal will sound before it has completely faded out (or until its echoes have been ultimately absorbed by the boundaries within the given "room"). The maximum length of this decay will vary dependent upon which reverb type is active.

RV HF DAMP High Frequency Damping is used to control the amount of high frequency information in the reverb signal.

LOW FREQ This parameter determines the amount of low frequency information in the reverb signal.

REV TYPE This parameter determines the current active reverb type (Room, Plate, etc.).

DIR IN PAN This parameter allows you to pan the direct input signal to the reverb section to the left or right - allowing for only the left or right channel to be reverberated when used with the Dual reverb type, or, for one channel to be reverberated to a greater degree than the other. This parameter is adjustable from 0 to 100 - where "0" = full left, "100" = full right and "50" = center.

PREDELAY L This parameter determines the amount of time after a signal is input to the Intellipitch that the left channel signal will be input to the Reverb. Delaying the reverb signal provides greater separation of the input and reverb signals and helps to increase the apparent size of the Room, Hall, or Stadium.

PREDELAY R This parameter determines the length of time after a signal is input to the Intellipitch that the right channel signal will be input to the reverb.

GATE Gating the reverb signal closes down the decay of the reverb very quickly after a prescribed amount of time (most commonly a very short period of time). This effect is often used on drums (particularly snare drums) to produce the effect of a much fatter percussive sound. Note that gating on the Intellipitch acts on the reverb decay, not on the reverb output as on many other units.

GATE DECAY This parameter determines how quickly the gate will close down the reverb decay after the reverb has sounded for the specified time.

GATE THRESH The Gate Threshold determines the threshold point at which gating will take place. When the signal is below this threshold point for a period of time, the reverb will be gated. When the input signal peak rises above this threshold, the gate will open and reverb will be heard.

HOLD TIME The Hold Time determines how long the reverb signal will sound before the gate begins to close.

DELAY Function

Delay is simply a reproduction of the input signal, originating at a prescribed time (usually expressed in milliseconds, or mS) following the input signal.

Delay Types

The Intellipitch *Hush; Delay; Ducker* configuration offers 3 delay types: Stereo, Ping-Pong and 2-Tap.

The **Stereo** delay type provides two separate delays. This delay type is used for applications requiring two discrete delay lines with individual regeneration loops.

The **Ping-Pong** delay type regenerates each delay's output into the opposite delay's input instead of its own. This causes the delayed signals to bounce back and forth from the left channel to the right (provided the delay outputs are panned left and right).

The **2-Tap** delay type provides a single long delay line with two outputs and offers twice the delay time of the Stereo delay type.

Delay Parameters

DELAY — This parameter determines whether the Delay section is active (passing a signal) or muted (not passing a signal).

MUTE TYPE — This parameter allows for muting of the Delay section at its input (Pre), its output (Post) or both.

Muting the input (Pre) of the Delay restricts any signal from entering the delay section until the delay is switched in. When using a moderate amount of regeneration, switching out the delay with the input muted will generate a non-delayed signal which will play over the decaying regenerated signal which continues on after the delay is switched out.

Muting the output (Post) of the delay results in the delayed signal being immediately turned off when the delay is switched out. This means that delays and regeneration will not continue once the delay is switched out. If the output were *not* muted, signals input before switching the delay out would be allowed to regenerate - even after switching out the delay.

It is also possible to mute both the input and output (Both) so that no signal enters or exits the Delay section when it is not switched in.

LEVEL — These are individual level controls for each of the two delays available in the Delay section. These are not the same as the Delay Level parameter found in the Mixer function (which adjusts the overall level of both delay signals).

PAN	This allows for the panning of each delay to the left or right output, if desired. The Pan parameter is adjustable from 0 to 100 - where 0 = full left, 100 = full right and 50 = center.
DLY TIME	These parameters determine the amount of time after a signal is input that the delayed signal will begin to reproduce the input signal.
REGEN	This parameter is provided for each delay and determines the number of times the delayed signal will repeat itself. This is achieved by feeding the delayed output back into the input. Higher levels of regeneration will result in more repeats.
D TYPE	The Delay Type parameter determines whether the Stereo, Ping-Pong or 2-Tap delay type is currently active.
DL HF DAMP	Delay High Frequency Damping determines the amount of high frequency content in the delayed and regenerated signals. Higher amounts of damping will result in less high frequency information in the delayed signal.

DUCKER Function

The process of *ducking* enables the user to suppress the level of a given signal or effect dynamically, dependent upon the presence of another signal which is desired to be prominent. The Ducking feature of the Intellipitch works in conjunction with the Delay and Reverb sections to attenuate the delay and/or reverb level while a phrase is being played (resulting in a less cluttered, more intelligible sound), yet return each to its original level when the phrase ends—thus allowing for the full decay of the delayed and/or reverberated signal.

Ducker Parameters

DUCKER — In the *HUSH; Delay; Ducker* configuration, this parameter determines whether the Ducker is off or on.

In the *HUSH; Chorus; Delay; Reverb* and *HUSH; Pitch Shift; Delay; Reverb* configurations, this parameter determines whether the Ducker is either (A) off, (B) operating on the delay, (C) operating on the reverb, or (D) operating on both the delay and reverb.

SENSITIVITY — This parameter determines the threshold point above which the ducker will begin attenuating the delay and/or reverb signal. Until the input signal reaches this level, the delay/reverb signal will not be affected.

ATTENUATION — This parameter determines how much the delayed signal is attenuated (muted). It may be set for only a slight change in signal level or it can completely attenuate the delay/reverb signal so that no delayed or reverberated signal passes while ducking is active.

RELEASE RATE — This parameter is adjustable from .2 seconds to 9 full seconds, and determines the length of time it takes for the muted delay signal to return to its original signal level after the input signal falls below the threshold point set by the Sensitivity parameter.

VOICE/DLY Function

The Voice/Dly function is available only in the following Intellipitch configurations:

HUSH;CHORUS;DELAY;REVERB
HUSH;8 VOICE CHORUS;DELAY
HUSH;PITCH SHIFT;DELAY
HUSH;PITCH SHIFT;DELAY;REVERB

In each of the above configurations, a separate Voice/Dly function is provided for each chorus or chromatic pitch shift voice that the configuration provides—thus allowing each chorus or pitch shift voice to be configured independently. Alternatively, any of the voices provided by a given configuration's Voice/Dly functions can be used as a delay-only voice, either by turning the Depth parameter to "0" (in a chorus configuration) to disable the chorus effect, or by setting the Pitch and Fine parameters to "0" (in a pitch shift configuration) to disable the pitch shift effect.

CHORUS

The Chorus effect is achieved by using one or more delayed signals, detuning these delayed signals (slightly changing their pitch) then *modulating* this detune effect so that the amount of pitch detune is constantly varying. Using many delayed signals at different delay lengths—as well as using different detune amounts, modulation rates and modulation depths for each delayed signal—results in a rich, spacious stereo chorused signal.

Chorus VOICE/DLY Parameters

LEVEL — This parameter adjusts the volume of the delayed signal relative to the other voice(s) of the effect and is included in the parameter list for each voice (or each delay signal) of both the 8-Voice and 4-Voice Chorus effects. (This level control is not the same as the Chorus Level found in the Mixer function parameter list.)

PAN — The *Pan* parameter allows you to pan each voice of the chorused signal to the left or right channel. This parameter is adjustable from 0 to 100 (where 0 = full left, 100 = full right, and 50 = center).

DELAY — The *Delay* parameter determines the delay time (in milliseconds) for each tap of the chorus signal. It is this delayed signal that is detuned and modulated to produce the chorus effect. Using shorter delay times for this effect produces a tighter sounding chorused signal, while using longer delay times will achieve a much larger, ambient effect.

DEPTH — The *Depth* parameter adjusts the amount of modulation of each delayed signal. A lower depth setting will produce a more subtle detune effect while a higher setting of this control will cause a more drastic detuning of the delayed signal.

RATE — The *Rate* parameter determines the sweep speed for the delayed signal (i.e. the speed at which the delayed signal is modulated). A low rate results in a slow speed and a higher rate results in a faster speed.

PITCH SHIFT

Pitch Shifting is used to produce harmony notes (up to four, depending on the current configuration) based on the pitch of the input signal. The Intellipitch provides four different pitch shift configurations—two for *chromatic* shifting, one for *intelligent* shifting and one for a special *reverse* shift effect.

Pitch Shift Types

Chromatic pitch shifting produces a harmony note that is always a fixed chromatic interval (or number of semitones) above or below the input note. Each harmony voice may be of any fixed interval—from to one octave above the input signal to two octaves below—and is adjustable in 20 cent increments. Increments of one cent (1/100th of a semitone) are also available for fine adjustment via the Fine parameter.

Intelligent pitch shifting differs from chromatic pitch shifting in that the harmony notes that are produced are always generated diatonically within a user-specified key and scale type. Therefore, any input note played in the prescribed key will result in harmony notes that are also in the proper key.

Reverse shifting is a special effect that allows for the delayed pitch sample to be played back in reverse after its prescribed delay time has expired.

Pitch Shift Configurations

The Intellipitch provides four different configurations for pitch shifting. The pitch shift configurations provided by the Intellipitch can be summarized as follows:

Hush; Pitch Shift; Delay provides four voices that can each be used for chromatic pitch shifting and/or delay, as well as HUSH noise reduction.

Hush; Pitch Shift; Delay; Reverb provides two voices that can be used for chromatic pitch shifting and/or delay, as well as an additional dedicated delay line. This configuration also provides HUSH, reverb, and ducking functions.

Hush; Intelligent Pitch Shift provides two voices that can be used for intelligent (or diatonic) pitch shifting and/or delay.

Hush; Reverse Pitch Shift provides two voices that can be used for pitch shifting with a special reverse effect. Reverse shifting allows for the delayed pitch sample to be played back in reverse after its prescribed delay time has expired.

Note

Pitch shift parameters accessible from Voice/Dly functions refer only to the chromatic pitch shift configurations (*Hush; Pitch Shift; Delay* and *Hush; Pitch Shift; Delay; Reverb*), and these parameters are as described below.

The pitch shift parameters for the *Hush; Intelligent Shift* and *Hush; Reverse Shift* configurations are discussed later in this chapter.

Chromatic Pitch Shift VOICE/DLY Parameters

(Used in the *Hush; Pitch Shift; Delay* and *Hush; Pitch Shift; Delay; Reverb* configurations)

PITCH — The *Pitch* parameter determines the harmony note that the Intellipitch will produce based on the input note. An interval is the distance in semitones between the pitches of two musical tones (e.g., the distance from an *A* note to a *C* note is a minor third interval, equaling 3 half-steps or 300 cents). The Pitch parameter is adjustable in 20 cent increments and any interval may be selected from one octave above to two octaves below the input signal. This parameter is adjustable from -2400 to +1200 (where -2400 = 2 octaves below the input signal, 0 = unison, and +1200 = one octave above the input signal). Each 100 cents (or five 20-cent steps) above or below 0 represents the amount of half-steps (or semitones) the harmony note will be above or below the input signal.

FINE — The *Fine* parameter allows for fine adjustment of pitch change in 1-cent steps (or 1/100th of a semitone) for finer adjustment of the harmony note.

LEVEL — The *Level* parameter determines the volume of each voice relative to the other voices of the effect.

Note: This parameter is not the same as the Pitch Shift Level parameter found in the Mixer function parameter list.

PAN — This parameter allows you to pan the shifted note to the left or right channel of the Intellipitch. It is adjustable from 0 to 100 (where 0 = full-left, 100 = full-right and 50 = center).

DELAY — This parameter allows for the shifted signal to be delayed up to 418mS following the input signal. It is adjustable from 0 to 418mS in 2mS increments.

Determining Chromatic Intervals by Cent Value

Intellipitch *Pitch* Parameter Value	Corresponding Interval
+1200	*one octave*
+1100	*Major 7th*
+1000	*minor 7th*
+900	*Major 6th*
+800	*minor 6th*
+700	*perfect 5th*
+600	*diminished 5th*
+500	*perfect 4th*
+400	*Major 3rd*
+300	*minor 3rd*
+200	*Major 2nd*
+100	*minor 2nd*
0	*unison*
-100	*Major 7th*
-200	*minor 7th*
-300	*Major 6th*
-400	*minor 6th*
-500	*perfect 5th*
-600	*diminished 5th*
-700	*perfect 4th*
-800	*Major 3rd*
-900	*minor 3rd*
-1000	*Major 2nd*
-1100	*minor 2nd*
-1200	*one octave*
-1300	*one octave plus a Major 7th*
-1400	*one octave plus a minor 7th*
-1500	*one octave plus a Major 6th*
-1600	*one octave plus a minor 6th*
-1700	*one octave plus a perfect 5th*
-1800	*one octave plus a diminished 5th*
-1900	*one octave plus a perfect 4th*
-2000	*one octave plus a Major 3rd*
-2100	*one octave plus a minor 3rd*
-2200	*one octave plus a Major 2nd*
-2300	*one octave plus a minor 2nd*
-2400	*two octaves*

Intervals above the input signal

Equal to the input signal

Intervals below the input signal

***Note**: There are 5 steps of the PARAMETER ADJUST control between each of the above intervals, as each step is equal to 20 cents. This allows for use of the Pitch parameter with an expression controller (such as a volume pedal used with a Rocktron Midi Mate foot controller) to change the pitch by remote means, and provides smooth pitch change when the controller is used.*

INTELLIGENT SHIFT Function

The *Hush; Intelligent Shift* configuration provides two voices that can be used for intelligent (or *diatonic*) pitch shifting. Intelligent pitch shifting produces harmony notes that are always generated diatonically within a user-specified key and scale type when the user plays in key. Therefore, any input note played in the prescribed key will result in harmony notes that are also in the proper key.

Intelligent Shift Parameters

Please note that, when selecting the key for an Intelligent Shift preset, the symbol "♯" refers to a sharp key, and the symbol "♭" referes to a flat key.

KEY — The *Key* parameter defines the tonic, or root note, that the Intellipitch will use in conjunction with the current *Mode* setting to generate the correct harmony notes. Note that sharp keys are represented by the "♯" character, and flat keys are represented by the "♭" character.

MODE — The *Mode* setting defines the musical scale that the Intellipitch will use to generate the proper harmony notes. Any of the following scales may be selected:

IONIAN	LYDIAN	LOCRIAN	BLUES	WHOLE TONE
DORIAN	MIXOLYDIAN	PENTATONIC	MELOD MINOR	
PHRYGIAN	AEOLIAN	BLUES PENT	HARM MINOR	

The scalular structure for each of the above mode settings is shown in the following section (*"Using the Intelligent Shift Configuration"*).

INTERVL — The *Interval* parameter determines the scale degree from the input signal that the harmony note will be generated. For example, if *Interval* is set to 3, the harmony note generated will always be the third scale step above the input note based on the current key and mode selected.

DELAY — The *Delay* parameter allows for the shifted signal to be delayed up to 500mS following the input signal. It is adjustable from 0 to 500mS in 10mS increments.

LEVEL — The *Level* parameter determines the volume of each voice relative to the other voices of the effect.

> *Note: This Level parameter is not the same as the Pitch Shift Level parameter found in the Mixer function parameter list.*

PAN — The *Pan* parameter allows you to pan the shifted note to the left or right output of the Intellipitch. It is adjustable from 0 to 100 (where 0 = full-left, 100 = full-right, and 50 = center).

QUANT — The *Quantize* parameter determines how the Intellipitch will respond to input notes that are not exactly in pitch with any of the 12 even-tempered notes. Higher Quantize settings will pitch-correct the harmony notes produced to the nearest even-tempered interval any time that the input is slightly off pitch, and thus will restrict harmony notes from fluctuating if the input pitch varies (i.e., when vibrato is applied to a note). Lower settings of the Quantize parameter will not perform pitch correction on the harmony note, and therefore will allow it to fluctuate in pitch with the input note.

RANGE

The *Range* parameter can be used to optimize the pitch shifter for the best possible performance based on the current application. The following selections are available:

GUITAR BASS WIDE VOCAL

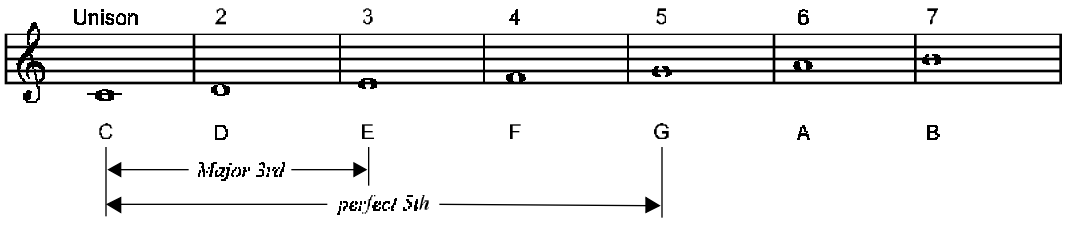
Selecting a range that is based on the current application will ensure the smallest delay and the smoothest pitch shift possible.

Using the Intelligent Shift Configuration

The *Mode* parameter provides many scales which the Intellipitch can use to determine harmony notes. Once the desired key and mode have been selected, each voice can provide a harmony note based on both the input note and the value of the *Interval* parameter selected for that particular voice.

The following examples illustrate the scalular structure of each of the available modes. Each example is shown using C as the tonic note (i.e., the *Key* parameter value).

Ionian



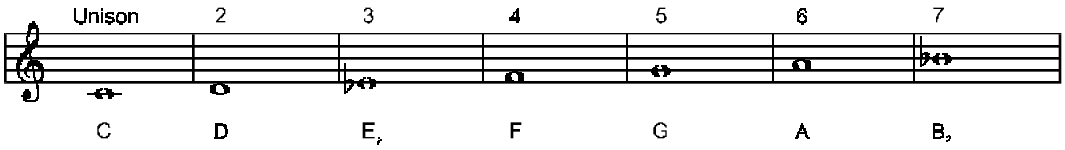
The staff above shows the scale steps for each note in an Ionian scale with a C tonic note.

With the Mode parameter set to "Ionian", setting an Interval parameter to "+THIRD" and playing a C note results in the Intellipitch producing an E harmony note, as E is the major 3rd interval from the tonic C. Likewise, setting the Interval parameter to "+FIFTH" results in the Intellipitch producing a G harmony note, as G is a perfect 5th from C.

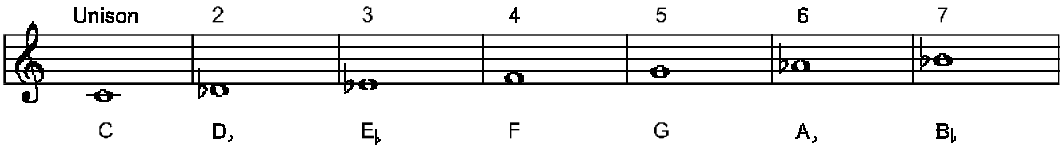
Playing any other note within the selected scale results in the Intellipitch determining the harmony note in the same manner. For example, playing a D note when the Interval parameter is set to "+THIRD" results in an F harmony note, as F is a 3rd interval from D when C is the tonic.

The following figures show the scalular structure of each of the remaining modes.

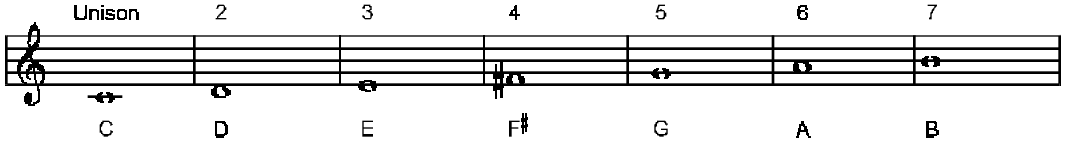
Dorian



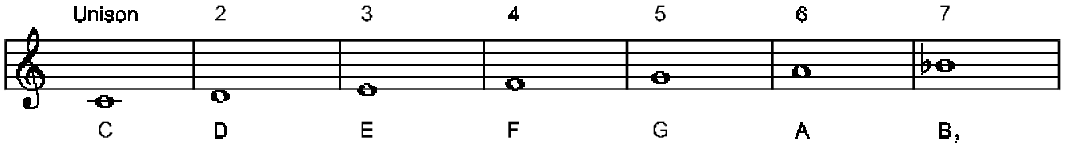
Phrygian



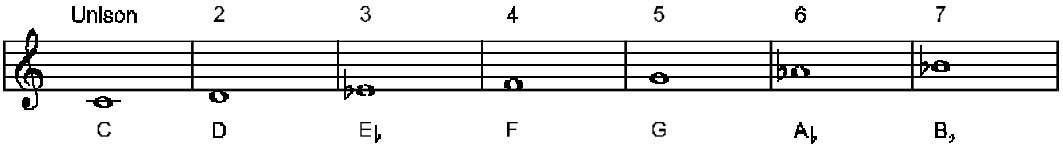
Lydian



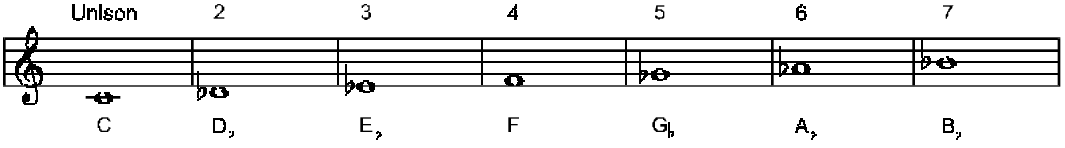
Mixolydian



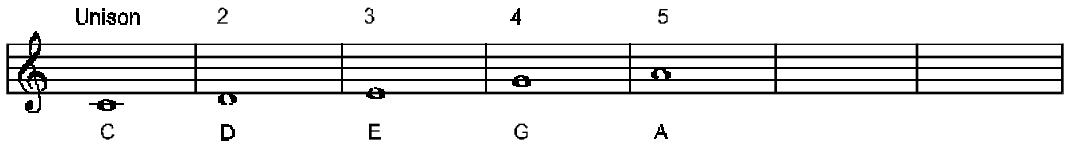
Aeolean



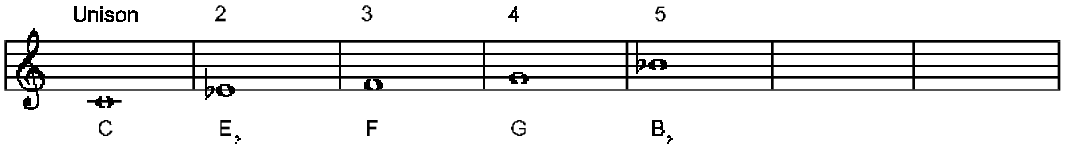
Locrian



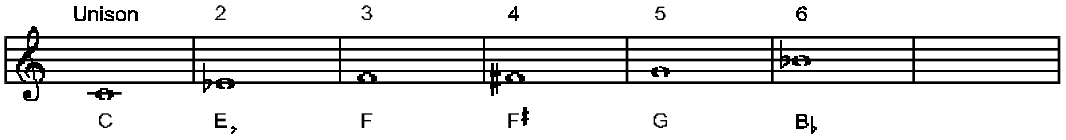
Pentatonic



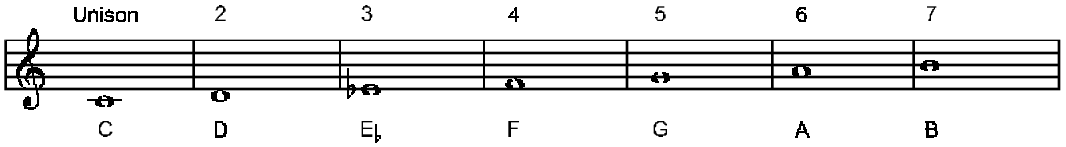
Blues Pent



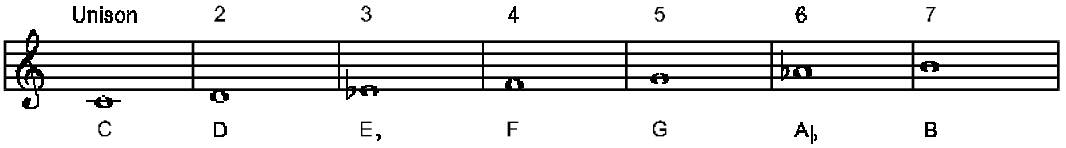
Blues



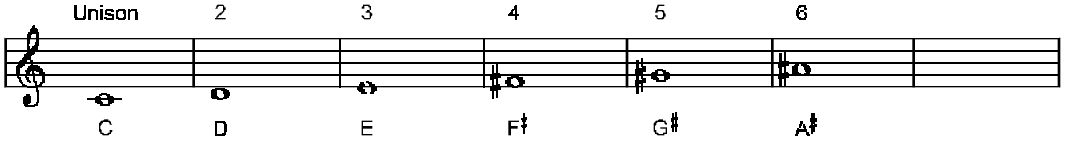
Melodic Minor



Harmonic Minor



Whole Tone



REVERSE SHIFT Function

The *Hush; Reverse Shift* configuration provides two voices that can be used for a special reverse pitch shifting effect. Reverse shifting allows for the delayed pitch sample(s) to be played back in reverse after its prescribed delay time has expired.

Reverse Shift Parameters

PITCH — The *Pitch* parameter determines the harmony note that the Intellipitch will produce based on the input note. An interval is the distance in semitones between the pitches of two musical tones (e.g., the distance from an *A* note to a *C* note is a minor third interval, equaling 3 half-steps or 300 cents). The Pitch parameter is adjustable in 20 cent increments and any interval may be selected from one octave above to two octaves below the input signal. This parameter is adjustable from -2400 to +1200 (where -2400 = 2 octaves below the input signal, 0 = unison, and +1200 = one octave above the input signal). Each 100 cents (or five 20-cent steps) above or below 0 represents the amount of half-steps (or semitones) the harmony note will be above or below the input signal.

LENGTH — The *Length* parameter determines the delay length before a sample is played back, and also determines the length of the sample. This parameter is adjustable up to 500 milliseconds.

DIR — The *Direction* parameter determines whether the delayed sample will be played back normally (*Forward*) or backward (*Reverse*).

REGEN — The *Regeneration* parameter determines the number of times that the delayed signal will be repeated.

LEVEL — The *Level* parameter determines the volume of the current voice being edited.

PAN — This parameter allows you to pan the shifted note to the left or right channel of the Intellipitch. It is adjustable from 0 to 100 (where 0 = full-left, 100 = full-right and 50 = center).

TRIGGER — The *Trigger* parameter allows you to set a predetermined level, above which the Intellipitch will begin sampling the input signal (rather than the continuous sampling that normally occurs).

As an example, this parameter could be set such that the transient that is produced by the picking of a note triggers the sampling function, while the decay of the note itself is below the threshold level and does not generate any sampling. This technique allows for some interesting and more controllable call-and-response interaction between the input note and reversed harmony note while playing.

XFADE — The *XFade* parameter determines the speed and smoothness of how shifted notes will move from one interval to another.

7. Configurations

At the root of each preset's sound is its *configuration.* The configuration determines

(a) the active effects for a given preset,
(b) the adjustable parameters available for a preset, and
(c) the order in which the effects are routed in the signal path.

The Intellipitch provides 8 highly flexible configurations capable of producing sounds which previously could only be obtained by patching numerous effects together. These configurations offer many simultaneous effects without suffering any degradation of the sound quality of each effect.

The available Intellipitch configurations are configured as follows:

❶ HUSH / Chorus / Delay / Reverb
❷ HUSH / Reverb
❸ HUSH / Delay / Ducker
❹ HUSH / 8 Voice Chorus / Delay
❺ HUSH / Pitch Shift / Delay
❻ HUSH / Pitch Shift / Delay / Reverb
❼ HUSH / Intelligent Shift
❽ HUSH / Reverse Shift

Selecting a Configuration

To select a specific configuration, press the CONFIG button—the CONFIG LED above the button will light and the Intellipitch will display the configuration for the current preset. Turning the PRESET control while in this mode will step through each preset, displaying each preset's configuration instead of its preset number and title.

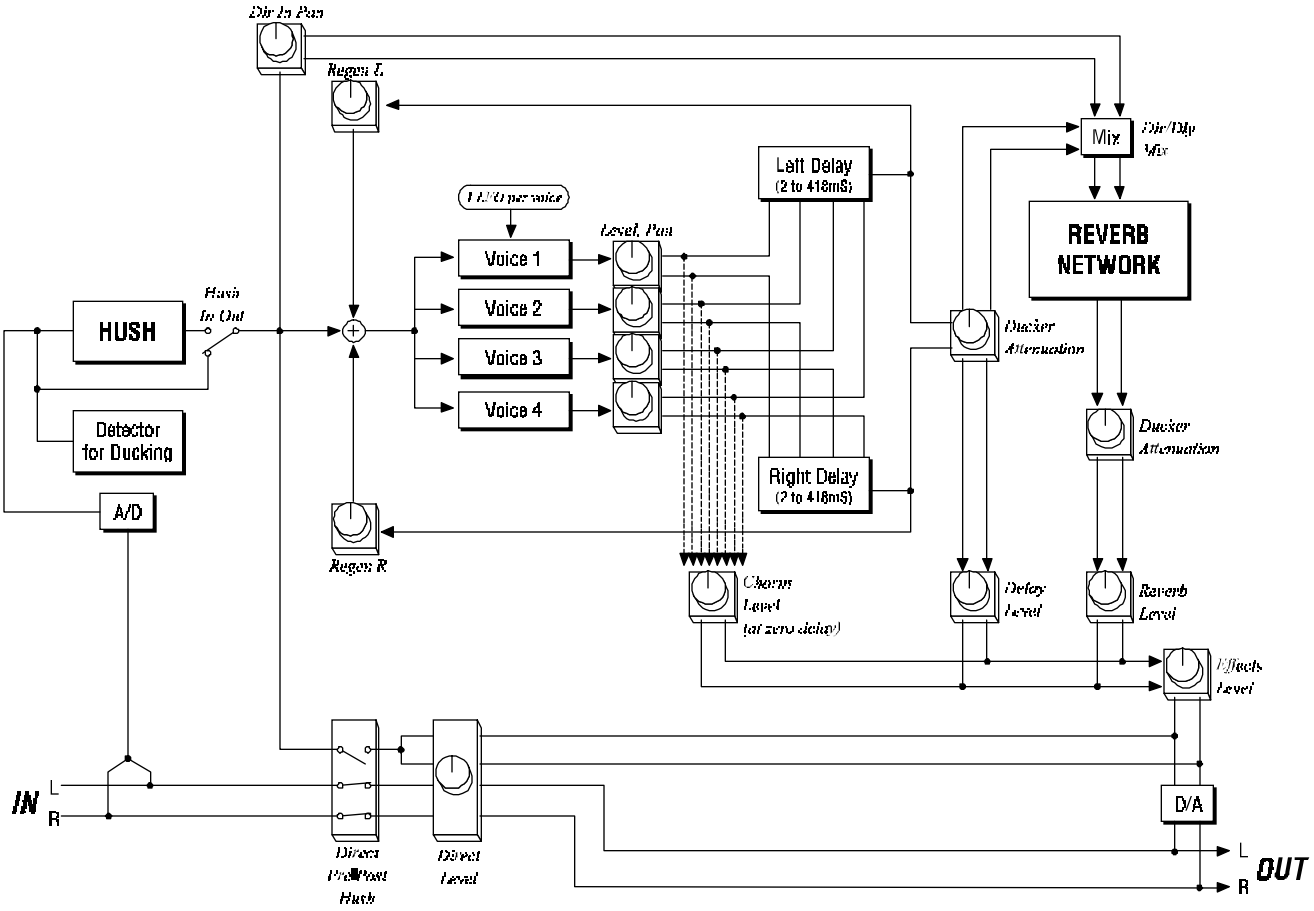
If a particular configuration is required for a specific preset location, locate an existing preset that uses that configuration and copy it into the desired location. (See the section entitled *"Storing Modified Parameter Values"* in section 8 for more information on copying presets.)

The basic signal path arrangements for each of the Intellipitch configurations are shown in this section, as well as their respective parameter lists. These diagrams illustrate the various signal flow possibilities available via the MIX, PAN and LEVEL controls located at various points in the signal chain.

HUSH / CHORUS / DELAY / REVERB Configuration

This configuration provides HUSH® noise reduction at the input to quiet a noisy input signal (such as from a high-gain guitar preamp) with 4 chorus/delay voices and reverb.

Note: When the Delay Time for any voice is set to zero, that voice is taken out of the regeneration loops. This will allow for higher regeneration levels (if needed). It also allows for a more pure sounding decay of the echo when used with other voices set at long delay times.

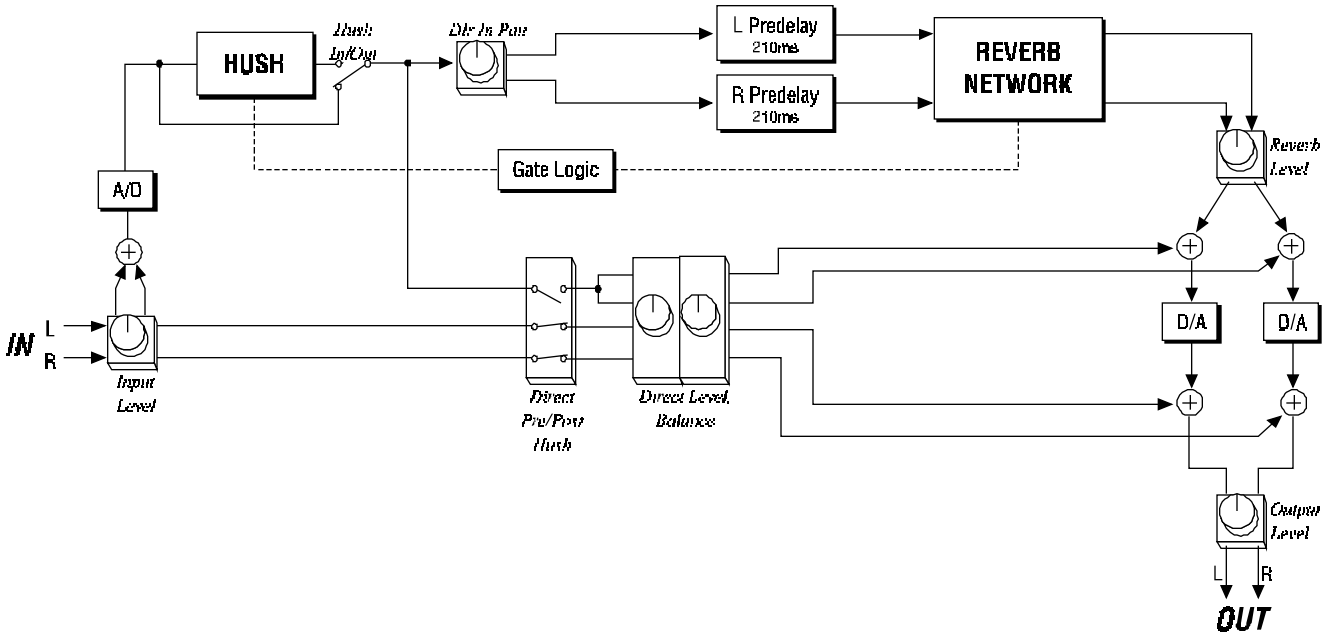


HUSH / CHORUS / DELAY / REVERB Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECTcontol*	Range *via PARAMETER ADJUST control*
MIXER	EFFECTS LVL	-∞ to +6.0dB
	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	DIRECT HUSH	PRE or POST
	CHORUS LVL	-∞ to 0dB
	DELAY LVL	-∞ to 0dB
	REVERB LVL	-∞ to 0dB
	REGEN L	-∞ to 0dB
	REGEN R	-∞ to 0dB
HUSH	HUSH I/O	IN or OUT
	EXP THRESH	-92 to -20dB
	REL RATE	25mS to 800mS
VOICE/DLY 1 *Repeated for Voices/Dlys 2, 3 and 4*	LEVEL 1	- ∞ to 0dB
	PAN 1	L<- 0 to 100 ->R
	DELAY	0 to 418mS
	DEPTH 1	0 to 100
	RATE 1	0 to 254
DUCKER	DUCKER	Off, Dly, Rev or Both
	SENSITIVITY	-92 to -20dB
	ATTENUATION	-∞ to 0dB
	RELEASE RATE	.2 to 9.0 Seconds
REVERB	REV INPUT	Active or Muted
	DIR IN PAN	L<- 0 to 100 ->R
	MIX DIR/DLY	DlR<- 0 to 100 ->DLY
	REVERB LVL	-∞ to 0dB
	REV DECAY	0 to 99
	RV HF DAMP	0 to 99

HUSH / REVERB Configuration

This configuration combines HUSH® noise reduction with high purity reverb sounds. Eight different reverb types are provided, along with up to 210mS of predelay.



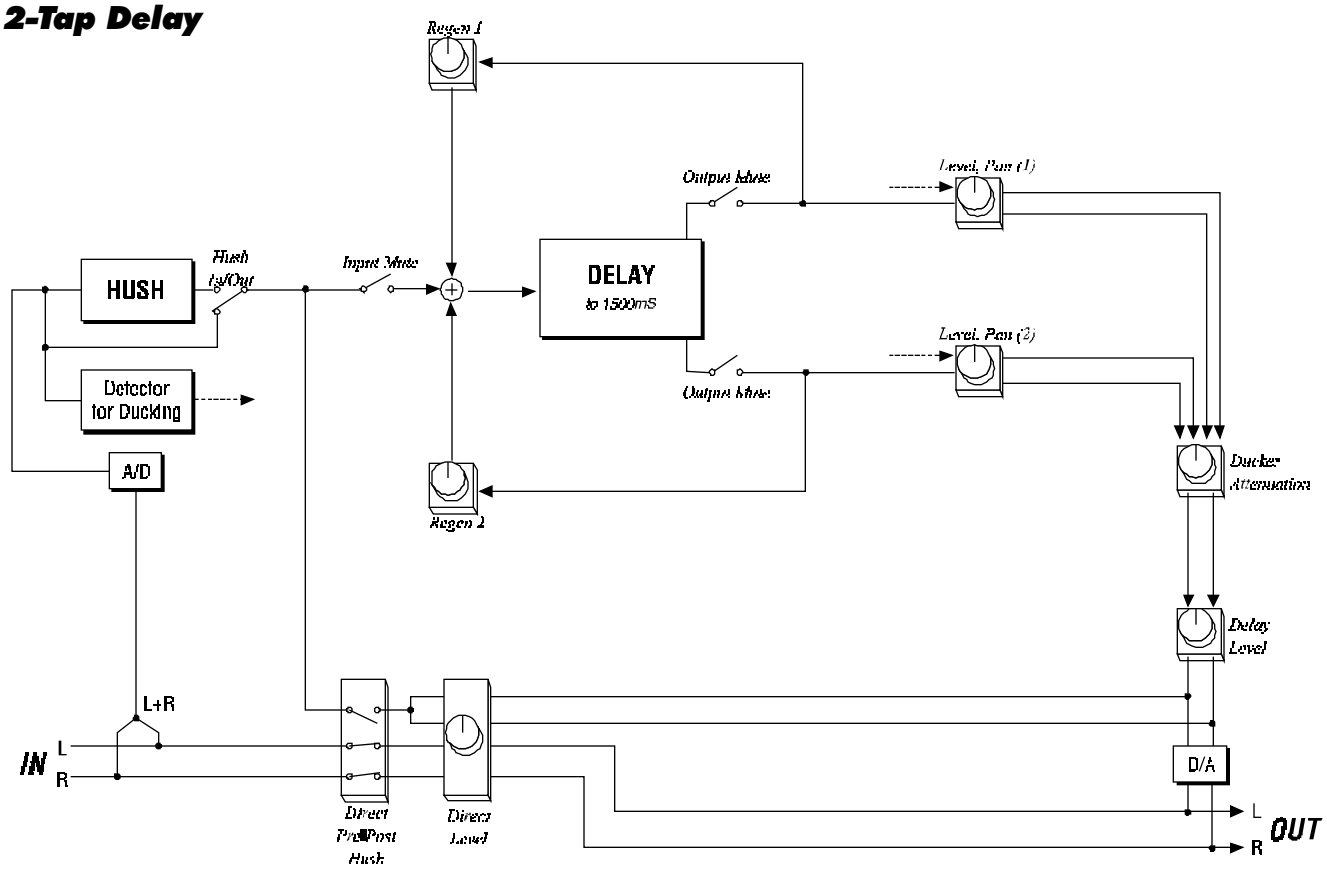
HUSH / REVERB Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST control*
MIXER	REVERB LVL	-∞ to +6.0dB
	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	DIRECT HUSH	PRE or POST
HUSH	HUSH I/O	IN or OUT
	EXP THRESH	-92 to -20dB
	REL RATE	25mS to 800mS
REVERB	REVERB LVL	-∞ to 0dB
	REVERB DECAY	0 to 99
	RV HF DAMP	0 to 99
	LOW FREQ	0 to 99
	REV TYPE	Plate A, Plate B, Room A, Room B, Dual, Hall A, Hall B, Stadium
	DIR IN PAN	L<- 0 to 100 ->R
	PREDELAY L	0 to 209mS
	PREDELAY R	0 to 209mS
	GATE	On or Off
	GATE DECAY	0 to 31
	GATE THRESH	-92 to -20dB
	HOLD TIME	0 to 99

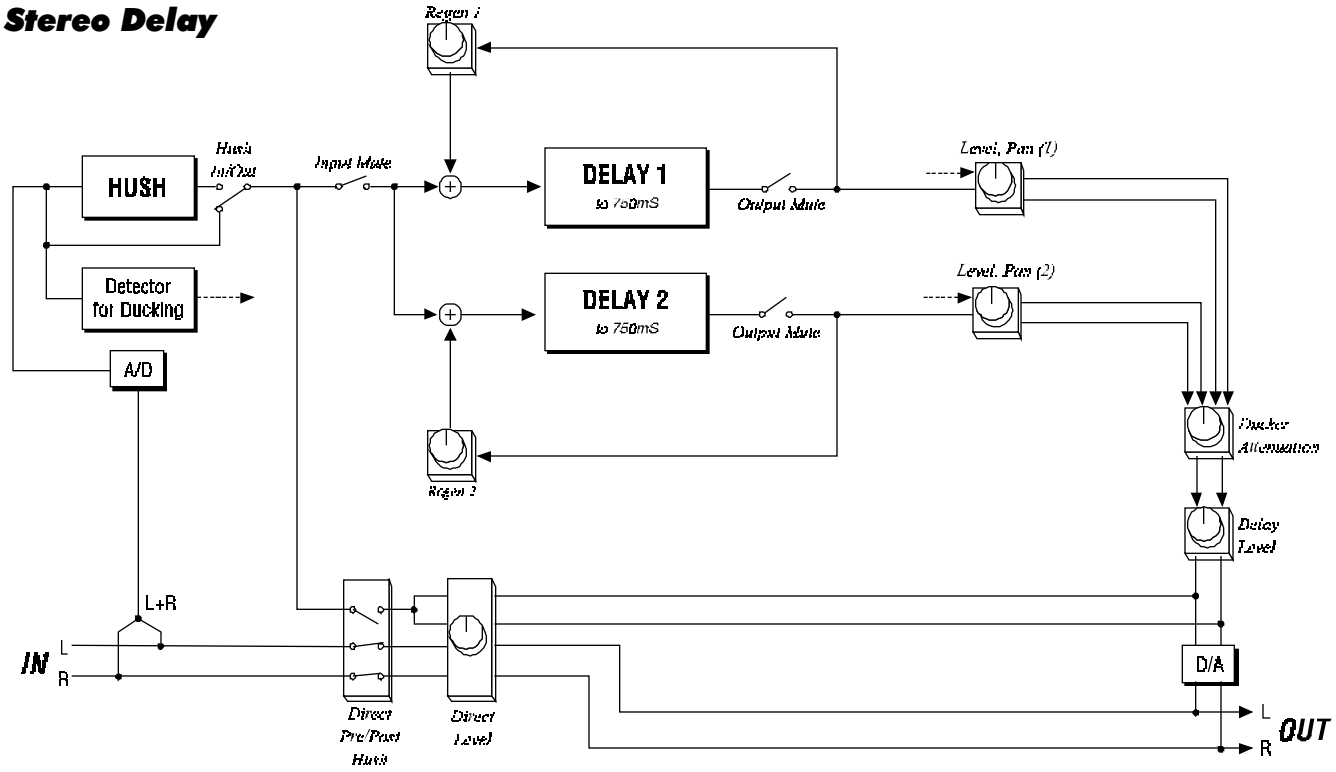
HUSH / DELAY / DUCKER Configuration

The Intellipitch offers three types of delay—2-Tap, Stereo and Ping-Pong. The configurations for each are shown.

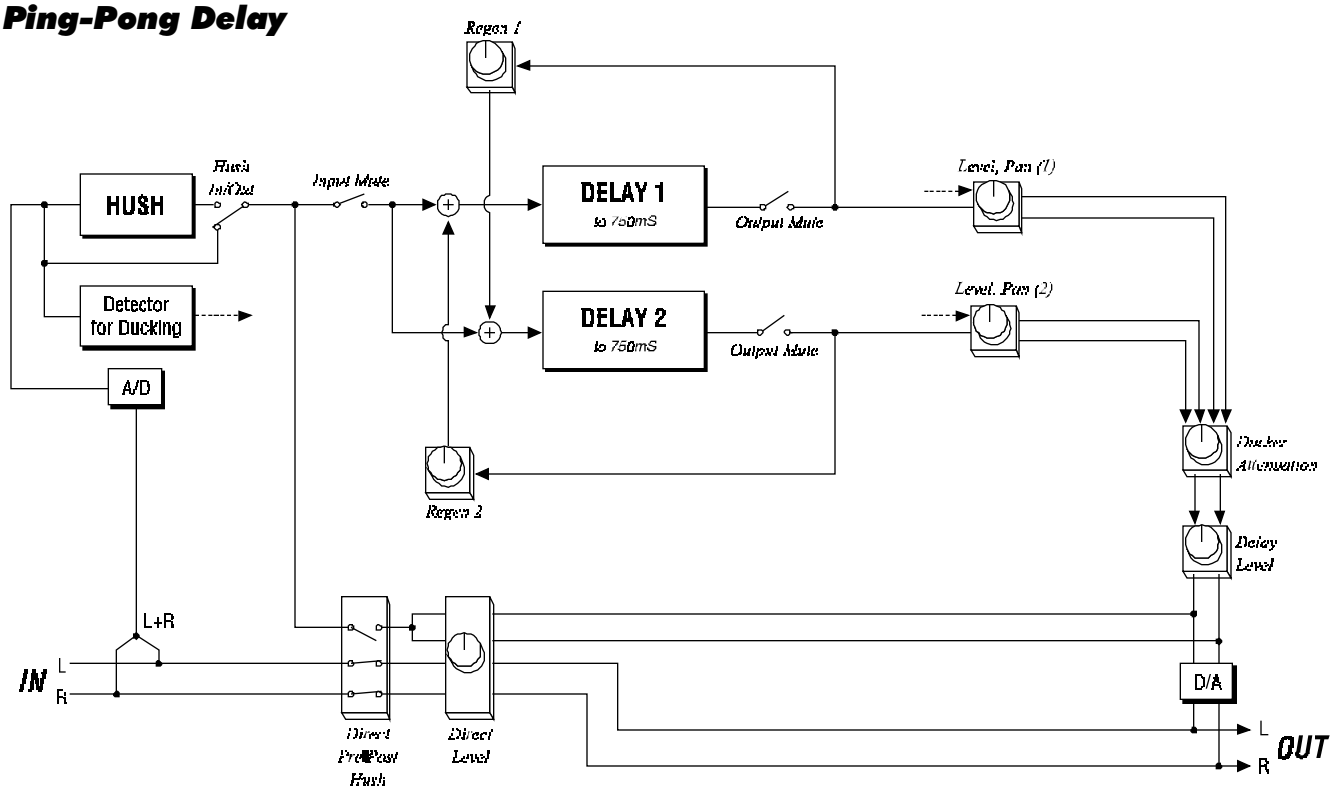
2-Tap Delay



Stereo Delay



Ping-Pong Delay



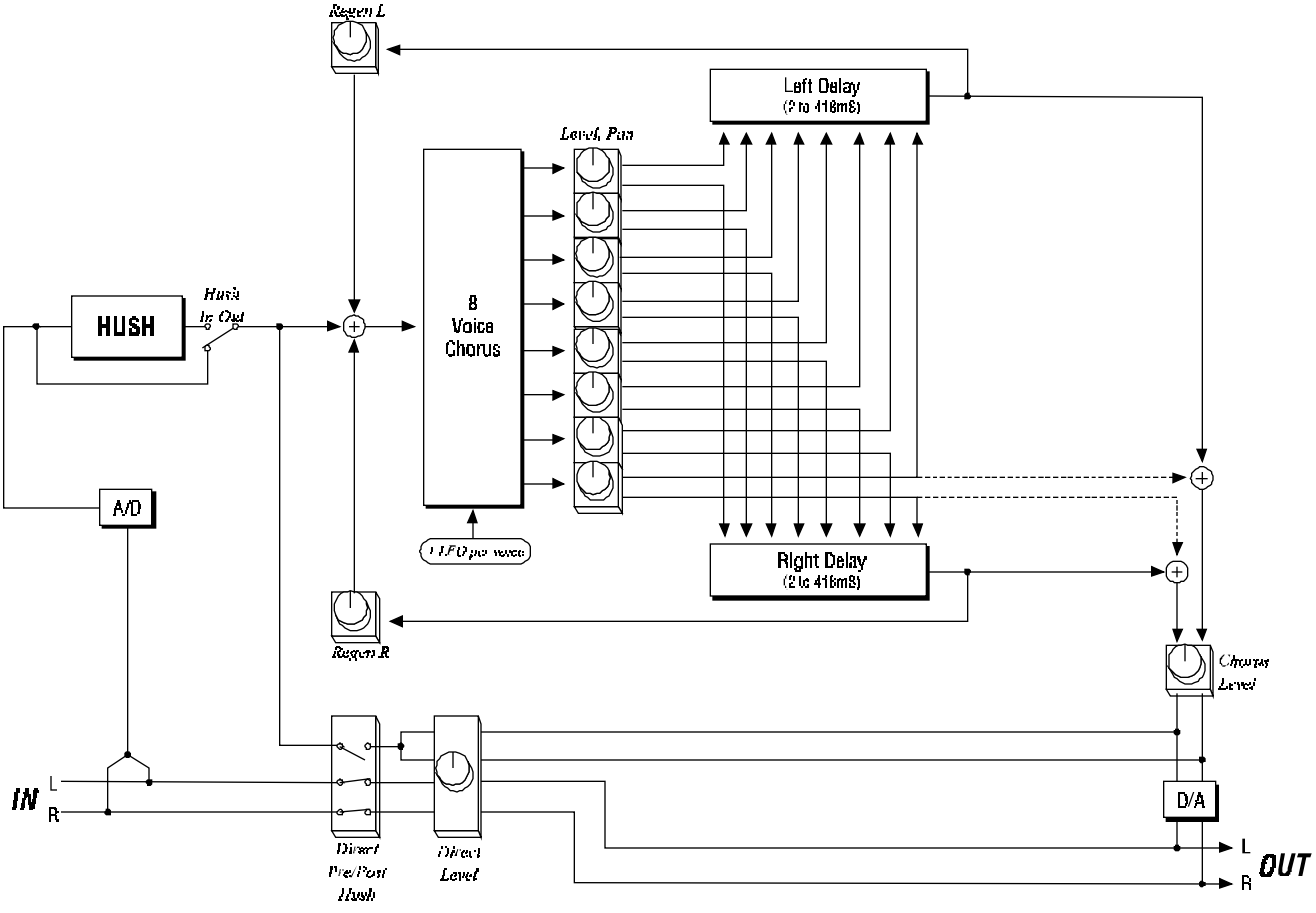
HUSH / DELAY / DUCKER Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECTcontrol*	Range *via PARAMETER ADJUST contol*
MIXER	DELAY LVL	-∞ to +6.0dB
	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	DIRECT HUSH	PRE or POST
HUSH	HUSH I/O	IN or OUT
	EXP THRESH	-92 to -20 dB
	REL RATE	25mS to 800mS
DELAY	DELAY	Muted or Active
	MUTE TYPE	PRE, POST or BOTH
	LEVEL 1	-∞ to 0dB
	PAN 1	L<- 0 to100 ->R
	DLY TIME 1	0 to 750mS (1500mS - 2 Tap)
	REGEN 1	-∞ to 0dB
	LEVEL 2	-∞ to 0dB
	PAN 2	L<- 0 to l00 ->R
	DLY TIME 2	0 to 750mS (1500mS - 2 Tap)
	REGEN 2	-∞ to 0dB
	D TYPE	2-Tap, Stereo, or Ping Pong
	DL HF DAMP	0 to 99
DUCKER	DUCKER	Off or On
	SENSITIVITY	-92 to -20dB
	ATTENUATION	-∞ to 0dB
	RELEASE RATE	.2 to 9.0 Seconds

HUSH / 8 VOICE CHORUS / DELAY Configuration

This configuration provides eight voices which may be chorused and/or delayed up to 418 milliseconds each.

Note: When the Delay Time for any voice is set to zero, that voice is taken out of the regeneration loops. This will allow for higher regeneration levels (if needed). It also allows for a more pure sounding decay of the echo when used with other voices set at long delay times.

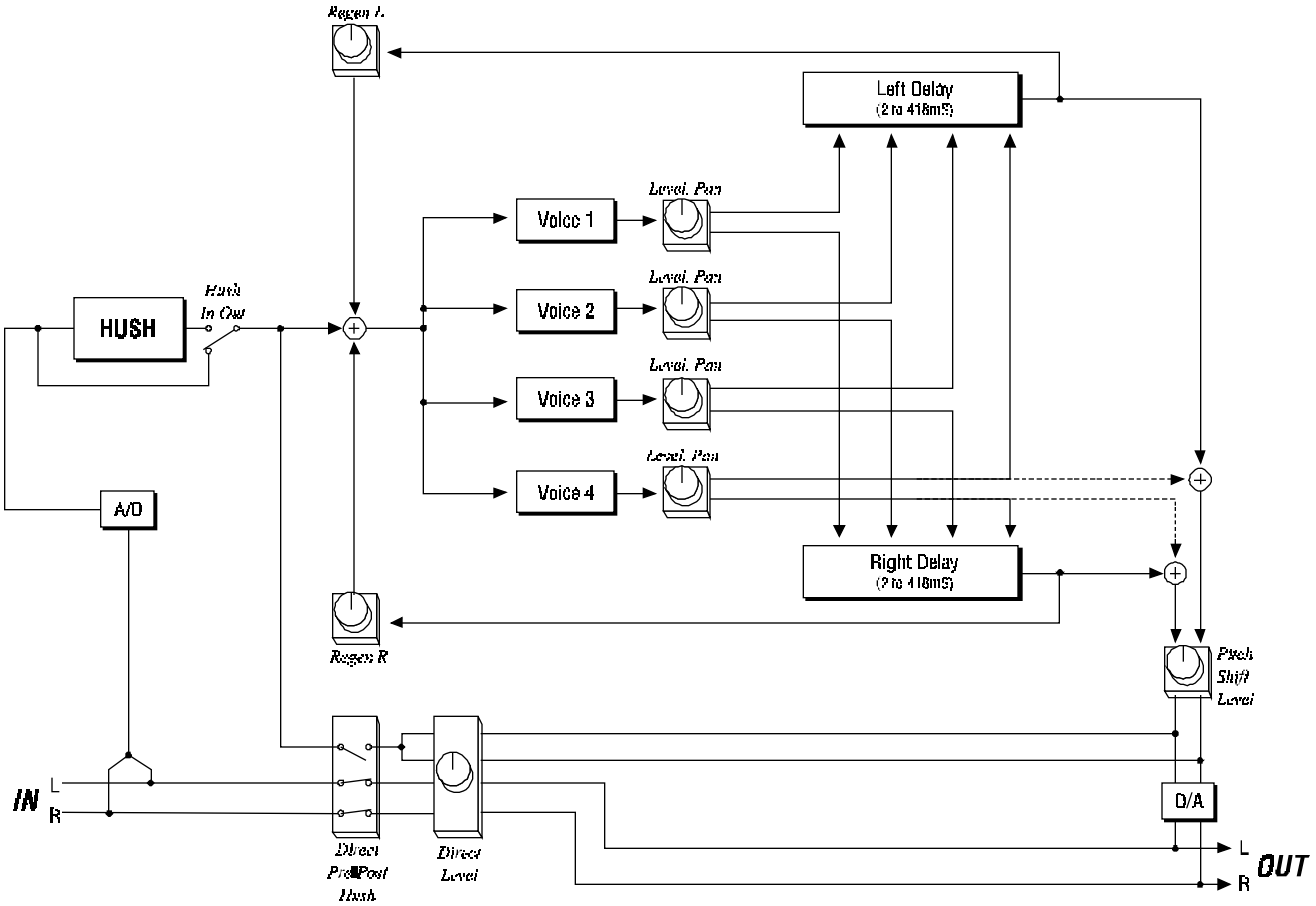


Dotted lines denote signal path of voice(s) set to 0ms Delay Time.

HUSH / 8 VOICE CHORUS / DELAY Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST contol*
MIXER	CHORUS LVL	-∞ to +6.0dB
	L DIR LVL	-∞ to +6.0dB
	R DIRLVL	-∞ to +6.0dB
	DIRECT HUSH	Pre or Post
	REGEN L	-∞ to 0.0dB
	REGEN R	-∞ to 0.0dB
HUSH	HUSH 1/0	In or Out
	EXP THRESH	-92 to -20dB
	REL RATE	25mS to 800mS
VOICE/DLY 1 *Repeated for Voices 2 - 8*	LEVEL 1	-∞ to 0dB
	PAN 1	L<- 0 to 100 ->R
	DELAY 1	0 to 418mS
	DEPTH 1	0 to 100
	RATE 1	0 to 254

HUSH / PITCH SHIFT / DELAY Configuration



Dotted lines denote signal path
of voice(s) set to 0ms Delay Time.

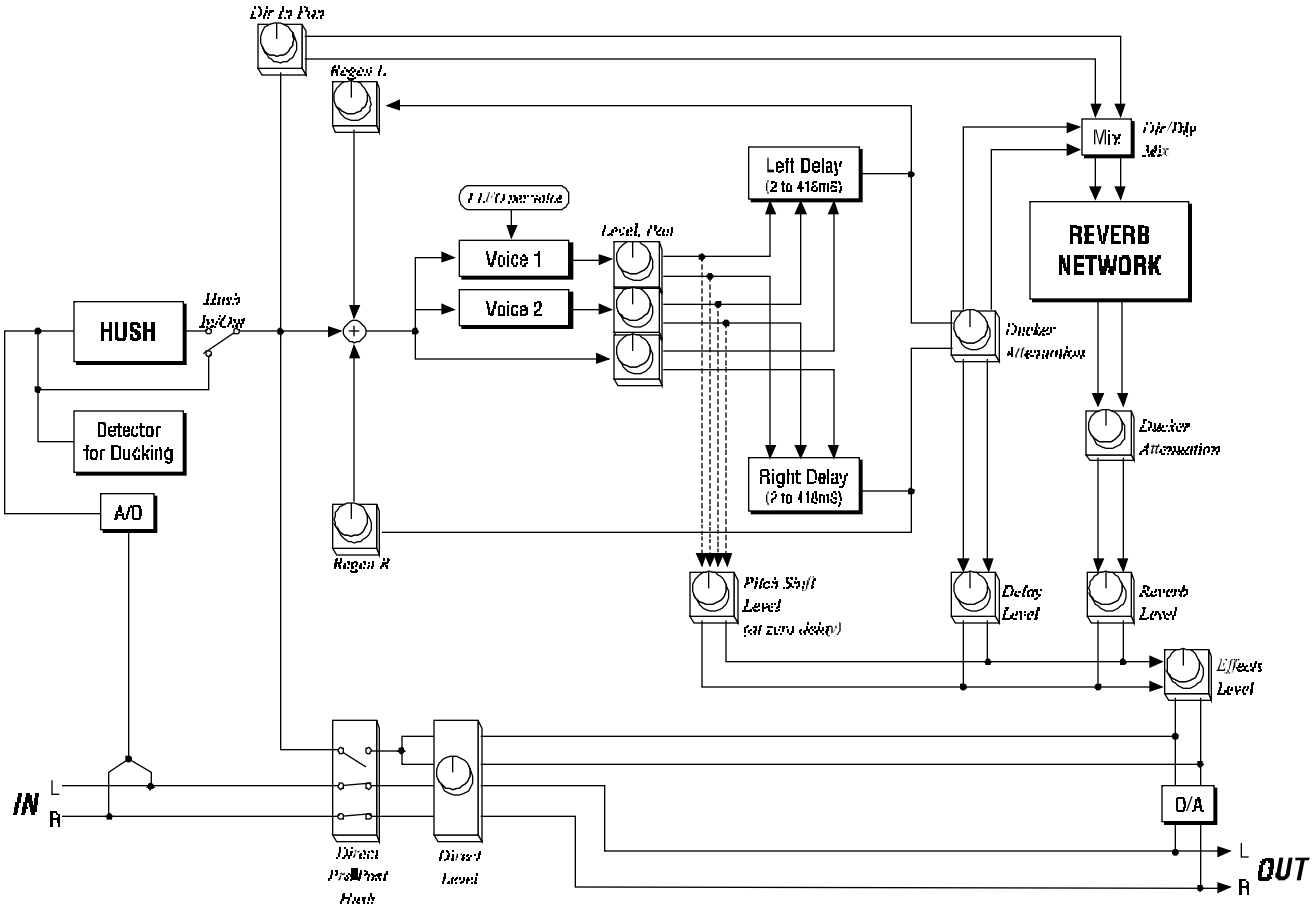
HUSH / PITCH SHIFT / DELAY Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST control*
MIXER	P SHIFT LVL	-∞ to +6.0dB
	L DIRLVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	DIRECT HUSH	Pre or Post
	REGEN L	-∞ to 0.0dB
	REGEN R	-∞ to 0.0dB
HUSH	HUSH I/O	In or Out
	EXP THRESH	-92 to -20dB
	REL RATE	25mS to 800mS
VOICE 1 *Repeated for Voices 2,3 and 4*	PITCH 1	-2400 to +1200
	FINE 1	-20 to +20
	LEVEL 1	-∞ to 0.0dB
	PAN 1	L<- 0 to 100 -> R
	DELAY1	0 to 418mS

HUSH / PITCH SHIFT / DELAY / REVERB Configuration

This configuration combines HUSH noise reduction with 2 voices of pitch shift/delay, along with a separate third delay. This is followed by a ducking feature for the delayed signals and reverb.

Note: When the Delay Time for any voice is set to zero, that voice is taken out of the regeneration loops. This will allow for higher regeneration levels (if needed). It also allows for a more pure sounding decay of the echo when used with other voices set at long delay times.

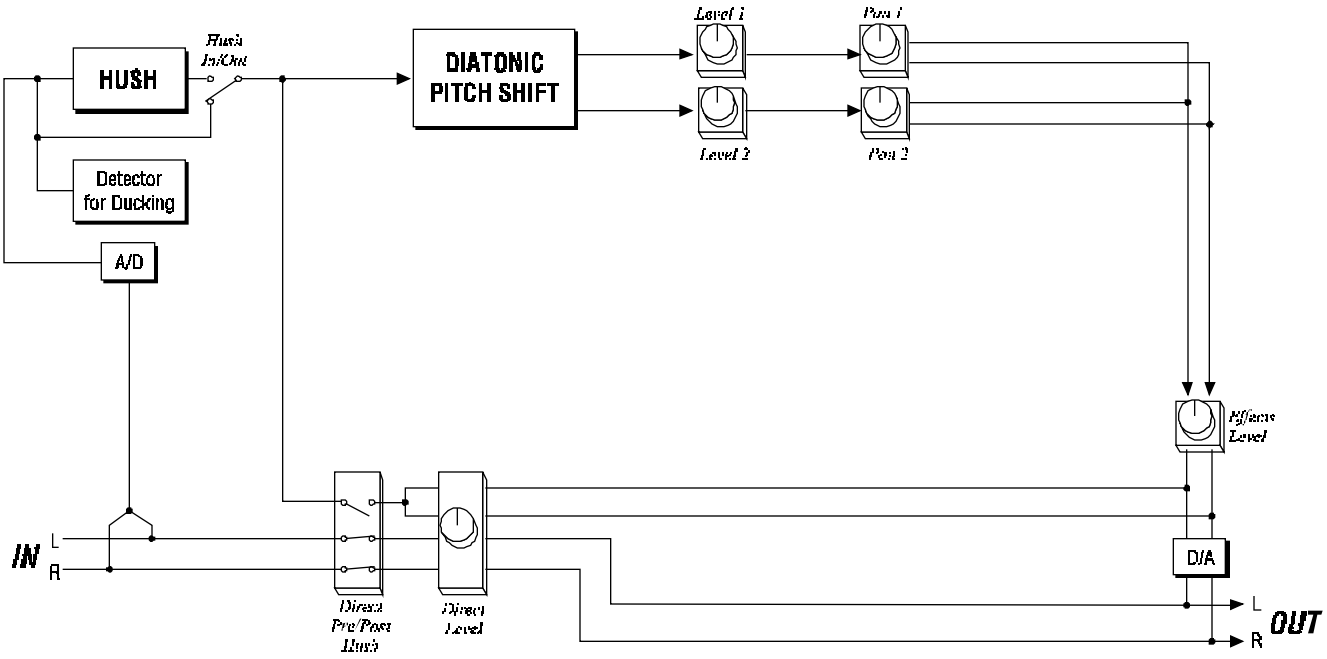


HUSH / PITCH SHIFT / DELAY / REVERB Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST contol*
MIXER	EFFECT LVL	-∞ to +6.0dB
	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	DIRECT HUSH	Pre or Post
	PSHIFT LVL	-∞ to 0.0dB
	DELAY LVL	-∞ to 0.0dB
	REVERB LVL	-∞ to 0.0dB
	REGEN L	-∞ to 0.0dB
	REGEN R	-∞ to 0.0dB
HUSH	HUSH I/0	In or Out
	EXP THRESH	-92 to -20dB
VOICE/DLY 1	PITCH 1	-2400 to +1200
	FINE 1	-20 to +20
	LEVEL 1	-∞ to 0.0dB
	PAN 1	L<- 0 to 100 ->R
	DELAY 1	0 to 418mS
VOICE/DLY 2	PITCH 2	-2400 to +1200
	FINE 2	-20 to +20
	LEVEL 2	-∞ to 0.0dB
	PAN 2	L<- 0 to 100 ->R
	DELAY 2	0 to 418mS
DELAY 3	LEVEL 3	-∞ to 0.0dB
	PAN 3	L<- 0 to 100 ->R
	DELAY 3	0 to 418mS
DUCKER	DUCKER	Off, Dly, Rev or Both
	SENSITIVITY	-92 to -20dB
	ATTENUATION	-∞ to 0dB
	RELEASE RATE	.2 to 9.0 Seconds
REVERB	REV INPUT	Active or Muted
	DIR IN PAN	L<- 0 to 100 ->R
	MIX DIR/DLY	DIR<- 0 to 100 ->DLY
	REVERB LVL	-∞ to 0dB
	REVERB DECAY	0 to 99
	RV HF DAMP	0 to 99

HUSH / INTELLIGENT PITCH SHIFT Configuration

This configuration combines HUSH noise reduction with 2 voices of intelligent (diatonic) pitch shifting. In this configuration, any of 13 different scales can be selected to determine the harmony notes that are generated for a specific key. Each voice can be shifted over a range of 2 octaves, and delayed up to 500 milliseconds.

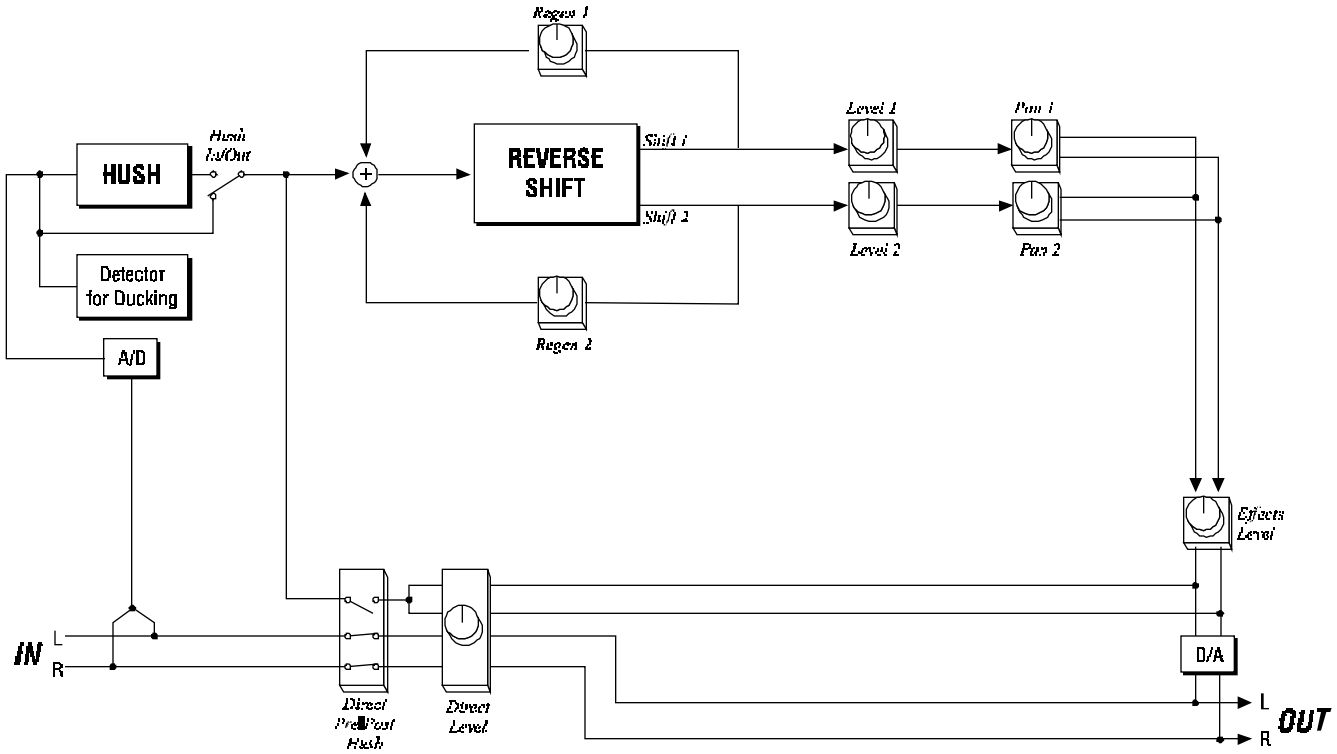


HUSH / INTELLIGENT PITCH SHIFT Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST contol*
MIXER	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	EFFECT LVL	-∞ to +6.0dB
	DIRECT HUSH	Pre or Post
HUSH	HUSH I/O	In or Out
	EXP THRESH	-92 to -20dB
INTELLIGENT SHFT	IPITCH	In or Out
	KEY	C, C#, D, D#, E, F, F#, G, G#, A, Bb, B
	MODE	IONIAN, DORIAN, PHRYGIAN, LYDIAN, MIXOLYDIAN, AEOLEAN, LOCRIAN, PENTATONIC, BLUES PENT, BLUES, MELOD MINOR, HARM MINOR, WHOLE TONE
	INTERVL1	-Octave to -2, Unison, +2 to +Octave
	DELAY1	0 to 500mS
	LEVEL1	-∞ to 0dB
	PAN1	L<0 to 100>R
	INTERVL2	-Octave to -2, Unison, +2 to +Octave
	DELAY2	0 to 500mS
	LEVEL2	-∞ to 0dB
	PAN2	L<0 to 100>R
	QUANT	0 to 100
	RANGE	Guitar, Bass, Wide, Vocal
	TUNER	In or Out
CAL PITCH SHIFT	PLAY - A	On or Off

HUSH / REVERSE PITCH SHIFT Configuration

This configuration combines HUSH noise reduction with two voices that can be used for a special reverse pitch shifting effect. Reverse shifting allows for each delayed pitch sample to be played back in reverse after its prescribed delay time has elapsed.

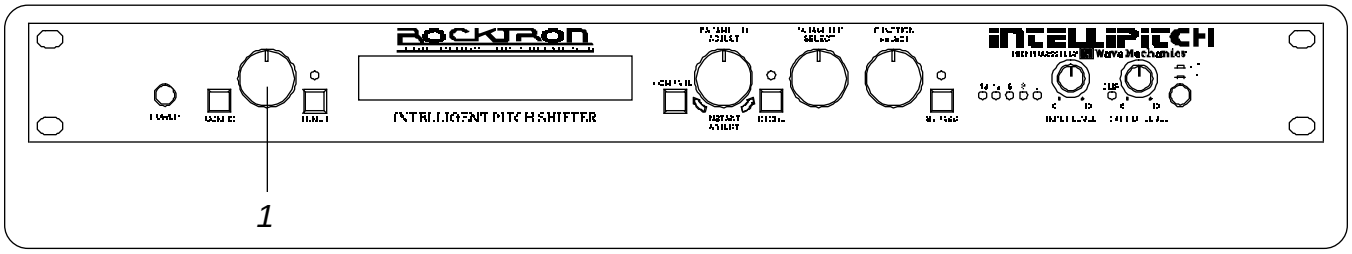


HUSH / REVERSE PITCH SHIFT Parameters

Function *via FUNCTION SELECT control*	Parameter List *via PARAMETER SELECT control*	Range *via PARAMETER ADJUST contol*
MIXER	L DIR LVL	-∞ to +6.0dB
	R DIR LVL	-∞ to +6.0dB
	EFFECT LVL	-∞ to +6.0dB
	DIRECT HUSH	Pre or Post
HUSH	HUSH I/O	In or Out
	EXP THRESH	-92 to -20dB
REVERSE SHIFT	REVERSE	In or Out
	PITCH 1	-2400 to +1200
	LENGTH 1	100 to 600 mS
	DIR 1	FORWARD, REVERSE
	REGEN 1	0 to 100
	LEVEL 1	-∞ to +6.0dB
	PAN 1	L<- 0 to 100 ->R
	XFADE 1	1 to 100
	PITCH 2	-2400 to +1200
	LENGTH 2	100 to 600 mS
	DIR 2	FORWARD, REVERSE
	REGEN 2	0 to 100
	LEVEL 2	-∞ to +6.0dB
	PAN 2	L<- 0 to 100 ->R
	XFADE 2	1 to 100
	TRIGGER	-10dB to -60dB

8. Operating the Intellipitch

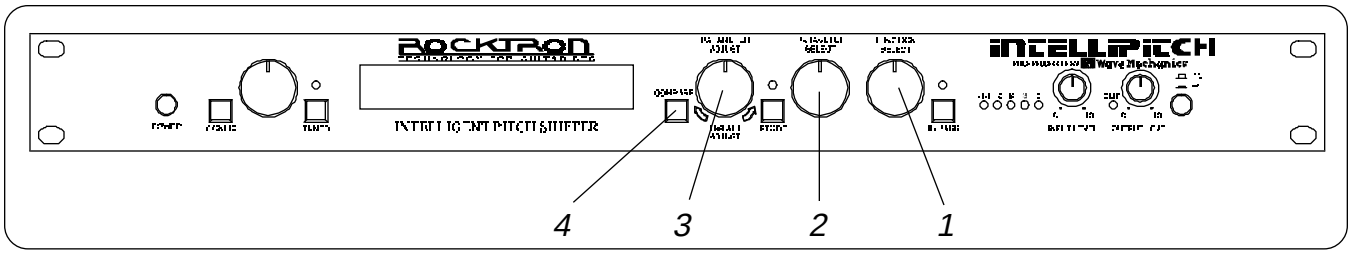
A. Recalling a stored Intellipitch preset



Step 1 To recall an Intellipitch preset, turn the PRESET control to the preset number to be recalled. The displayed preset will be recalled automatically.

14 PRESET TITLE

B. Changing preset parameters



Step 1 The parameter menu for each effect can be called up via the FUNCTION SELECT control. Turn this control to the effect to be edited.

***** REVERB *****

Step 2 Turn the PARAMETER SELECT control to select the specific parameter to be edited for the selected effect.

REV DECAY	59

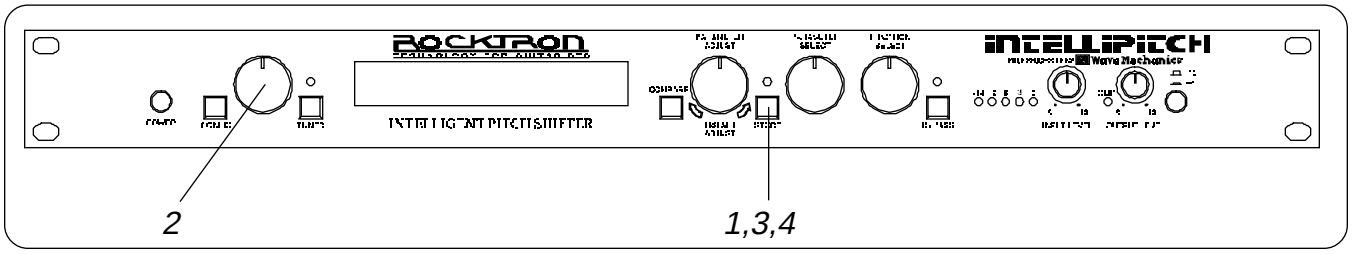
Step 3 Use the PARAMETER ADJUST control to change the parameter value. The LED above the STORE button will light, indicating that the preset has been altered from its original state.

REV DECAY	32

Step 4 The COMPARE button may be used to compare the old parameter value to the new one.

REV DECAY	59

C. Storing modified parameter values



Step 1 To store altered parameter values, press the STORE button while the effect title or parameter is displayed to start the store procedure. The display will alternate between the preset number/title that the changes will be stored to and:

STORE TO PRESET

Step 2 Turn the PRESET control to select the desired preset number to store the new parameter values into (if you wish to store the new parameter values into the current preset number, this step is not necessary). The display will now alternate between the new preset number and:

STORE TO PRESET

Step 3 Press the STORE button a second time to store the new values into the selected preset number. The display will briefly flash "STORED" before displaying the new preset number and title.

STORED

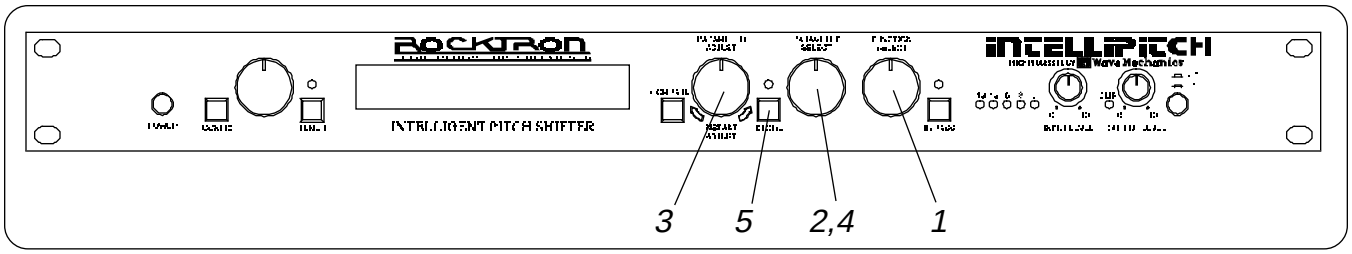
Step 4 After the altered parameter values have been stored into the selected preset number, the Intellipitch will display "COPY TITLE TOO?". This message is only displayed when storing into a new preset number, and allows you copy the title from the original preset into the new preset also, if desired. To copy the title from the original preset, press the STORE button a third time and the display will again flash "STORED".

STORED

Note 1 *If it is not desired to copy the title of the original preset, simply turn the PRESET control to any other preset or turn the FUNCTION SELECT control to any function to exit. The altered parameters will still be stored into the new preset number.*

Note 2 *If a preset with modified parameters is exited prior to completing the store procedure, all edited parameter values will be lost and the preset will revert back to its original status the next time it is recalled. When saving a preset's altered parameters, make sure the display flashes "STORED" before exiting the preset to ensure that it was indeed stored.*

D. Editing a preset title



Step 1 To use the Title Edit function, turn the FUNCTION SELECT control clockwise until the Intellipitch displays "TITLE EDIT".

TITLE EDIT

Step 2 Turn the PARAMETER SELECT control clockwise to initiate the Title Edit mode. This control is used to select the character location to be edited. The current character position to be edited is followed by a flashing decimal.

29 P.RESET TITLE

Flashing decimal

Step 3 Use the PARAMETER ADJUST control to select the desired character for the current position to be edited.

29 N.RESET TITLE

Step 4 To edit the character in the next position, turn the PARAMETER SELECT control one step clockwise—the flashing decimal will move to the next position.

29 NR.ESET TITLE

Flashing decimal at next position

Step 5 After all the desired characters have been edited, press the STORE button to save the new title. The Intellipitch will flash "STORED" briefly.

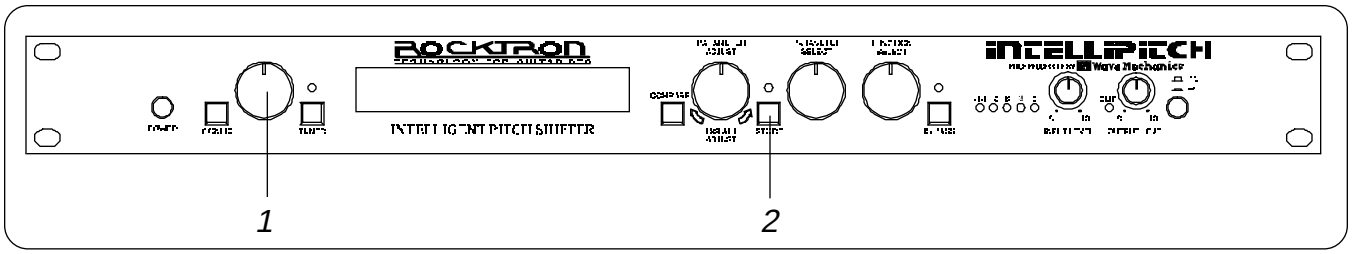
STORED

Note 1 *The STORE button **must** be pressed to save the new title. Exiting the Title Edit function before pressing the STORE button will erase any prior editing done in the Title Edit function.*

Note 2 *After flashing "STORED" briefly, the Intellipitch will remain in Title Edit mode. At this time, you may either (a) turn the PRESET control to display and edit other preset titles, or, (b) turn the FUNCTION SELECT control to exit the Title Edit function.*

E. Selecting a power on preset

The Intellipitch allows you to select the preset that will be recalled each time the unit is turned on.



Step 1 Turn the PRESET control to the preset number that is to be recalled each time the unit is turned on.

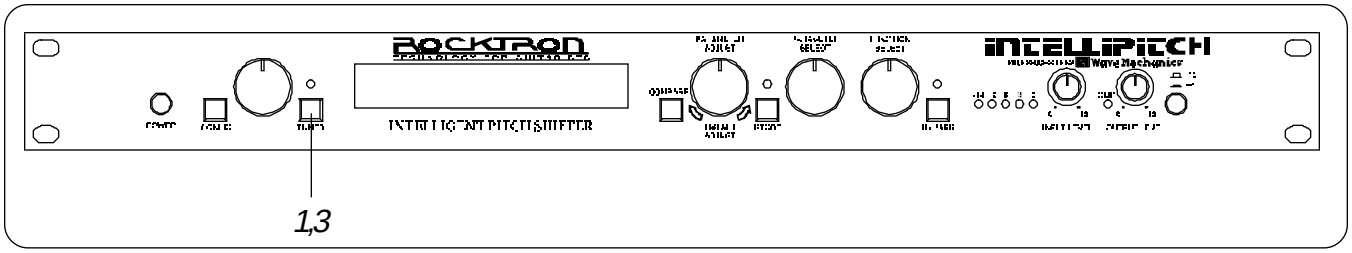
24 PRESET TITLE

Step 2 Press the STORE button while the preset number/title or configuration is displayed to save the current preset as the "power on" preset.

PWR ON PR STORED

F. Tuning your Instrument to the Intellipitch

The Intellipitch provides a built in tuner which allows you to tune your instrument to standard pitch, as well as calibrate the Intellipitch to the tuning of your instrument.



Step 1 Press the front panel TUNER button to initiate the Tuner function. The Intellipitch will briefly display "TUNER ACTIVE".

TUNER ACTIVE

Step 2 Play any note on the instrument, and the Intellipitch will display the note that was detected, as well as provide a visual indication of how far the instrument is from being perfectly in tune. An asterisk displayed to the left of the note detected indicates that the input note from the instrument is flat (slightly below the note displayed). An asterisk to the right indicates that the instrument is sharp (slightly above the note displayed).

✸ A

Indicates that the input note is flat

When the input note is tuned perfectly with the note that is displayed, the Intellipitch will display "TUNED", as shown below.

TUNED- A -TUNED

Step 3 When the instrument is tuned, press the TUNER button to exit the tuner function and recall the original preset.

1 PRESET TITLE

Additional ways to access the Tuner function…

Creating a Tuner preset

In addition to using the TUNER button, the tuner function can also be accessed in the *Intelligent Shift* configuration by storing the TUNER parameter "IN". Then, each time that preset is recalled, the Intellipitch will display the tuner in place of the preset title and number.

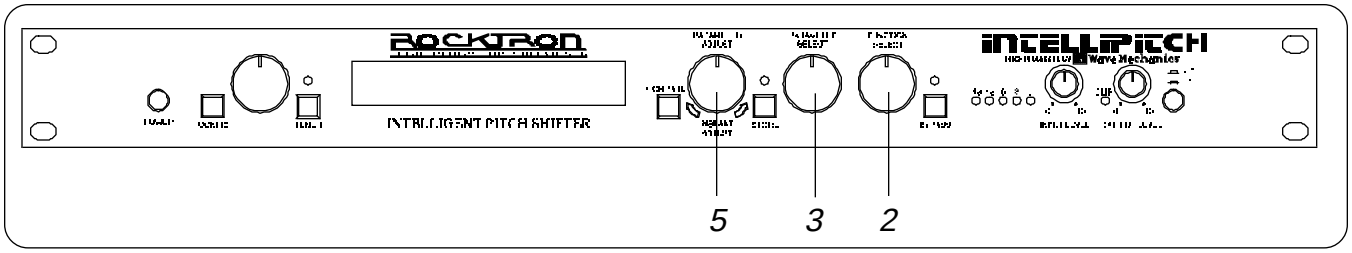
To access the functions and parameters of a tuner preset, recall the preset via a MIDI controller two times consecutively. Recalling the preset a second time will display the preset number and title, and allow access to all functions and parameters of the preset.

Access via MIDI controller

The tuner function can also be accessed by assigning the TUNER parameter to MIDI controller 20. (See the *"MIDI Operation"* section for a detailed description of controller assignments.)

G. Calibrating the Intellipitch to your Instrument

In addition to tuning your instrument to the Intellipitch, the Intellipitch can also be calibrated to the tuning of your instrument.



Step 1 From any Intelligent Pitch preset, ensure that the IPITCH parameter is currently "IN".

IPITCH	IN

Step 2 Turn the FUNCTION SELECT control to "CAL PITCH SHIFT".

CAL PITCH SHIFT

Step 3 Turn the PARAMETER SELECT control to "PLAY A OFF".

PLAY A	OFF

Step 4 Play the note on the guitar that is normally A-440 (G-string, 14th fret).

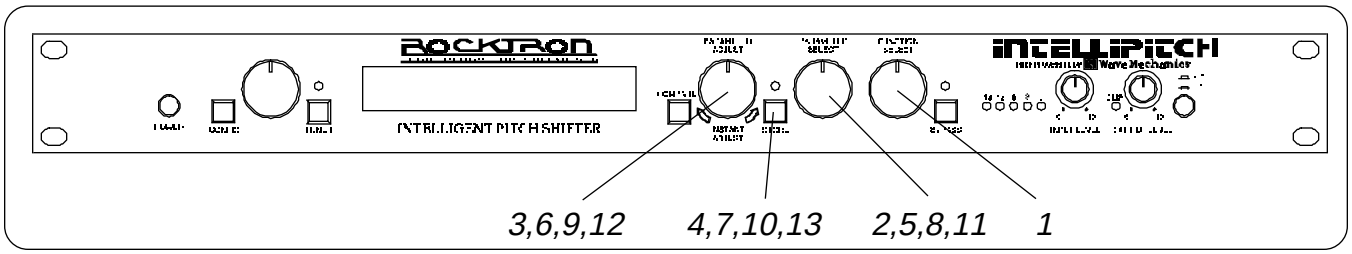
Step 5 As the note rings out, turn the PARAMETER ADJUST control. The Intellipitch will sample the input note and briefly display "CALIBRATED".

CALIBRATED

9. MIDI Operation

A. MIDI Controller Assignments

Controller mapping allows for specific Intellipitch adjustable parameters to be mapped (or assigned) to a MIDI controller number for real-time control (via a pitch wheel, expression pedal, etc.) in live performance situations. Any parameter may be assigned to any controller number, from controller 0 through controller 120, or OFF. In the OFF position, the assigned parameter will not respond to any MIDI control change. Each preset allows for up to 8 controllers.



Step 1 To access the Controller Assign function, turn the FUNCTION SELECT control one step clockwise past "Title Edit".

CONTROLLER ASSIG

Step 2 Turn the PARAMETER SELECT control to access the first parameter of the *Controller Assign* function. This parameter allows for the selection of a controller number which the first parameter (selected in Step 5) will respond to.

NUMB1 XXX

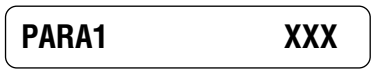
Step 3 Use the PARAMETER ADJUST control to select the controller number to be assigned to the first parameter (PARA1). You may choose any number from 0 to 120, or OFF so that the parameter will not respond to MIDI controller changes. Match this number with the MIDI transmitter controller number.

NUMB1 7

Step 4 After selecting the desired controller number, press the STORE button to save the number. "STORED" will flash briefly on the display.

STORED

Step 5 Turning the PARAMETER SELECT control one step clockwise will display the effect parameter that is currently mapped to the NUMB1 control number.



Step 6 Turn the PARAMETER ADJUST control to scroll through the available parameters for the current configuration.

Step 7 After selecting the parameter to be assigned to the NUMB1 controller, press the STORE button to save it. "STORED" will flash briefly on the display.

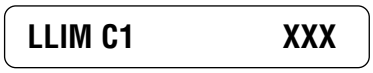
Note *The Intellipitch allows for the range of any given parameter to be limited when using a MIDI controller to determine the current parameter value. For example, if a given parameter has a range from -∞ to +6dB yet it is desirable for the full range of the controller to vary from only -10dB to +2.5dB, a lower limit of -10 and an upper limit of +2.5 may be set via the "Upper Limit" and "Lower Limit" parameters. When storing a parameter, the maximum value is stored as the upper limit and the minimum value is stored as the lower limit automatically.*

Step 8 Turn the PARAMETER SELECT control to display the next parameter - "Controller Upper Limit".

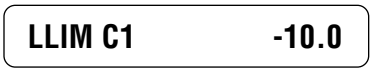
Step 9 Use the PARAMETER ADJUST control to select the highest parameter value that the controller is not to exceed.

Step 10 After selecting the value for the upper limit, press the STORE button to save it. "STORED" will again flash briefly on the display.

Step 11 Turn the PARAMETER SELECT control for the last parameter—*Controller Lower Limit.*



Step 12 Use the PARAMETER ADJUST control to select the parameter value which the controller is not to fall below.



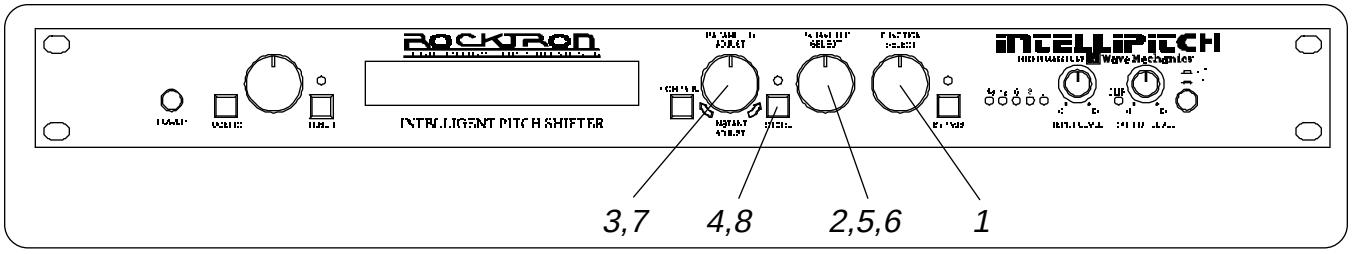
Step 13 After choosing a lower limit parameter value, press the STORE button to save it. "STORED" will flash briefly on the display.

Notes *This entire process is repeated 7 times for a total of 8 controllers (NUMB2, NUMB3, etc.). To exit Controller Assign at any time, turn the PRESET or FUNCTION SELECT controls. Only those changes that have been stored will be saved after exiting Controller Assign.*

Also, a lower limit may be selected which is greater than the upper limit. This will invert the response of the controller. For example, the toe position of an expression pedal would provide the minimum value while the heel position would provide the maximum value.

B. MIDI Program Mapping

Program mapping allows for an Intellipitch preset number to be mapped (or assigned) to a different MIDI program number. The Intellipitch is initially programmed at the factory to access to the lower 128 presets (i.e. program number 1 is mapped to preset 1, 128 to 128, etc.)



Step 1 To access the *Program Mapping* function, turn the FUNCTION SELECT control one step past the *Controller Assign* function.

**** PROG MAPPING ****

Step 2 Use the PARAMETER SELECT control to select the first parameter—*Program Mapping Status*. This parameter determines whether program mapping is on or off. When program mapping is OFF, the preset number recalled is identical to the program number sent via MIDI. When ON, the preset number recalled is the preset that the program number sent is mapped to.

PROG MAPPING OFF

Step 3 Select whether the program mapping is to be ON or OFF via the PARAMETER ADJUST control.

PROG MAPPING ON

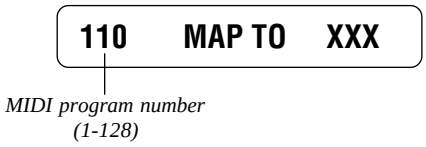
Step 4 Save the current Program Mapping status by pressing the STORE button. "STORED" will flash briefly on the display.

STORED

Step 5 Turn the PARAMETER SELECT control one step clockwise to view the current map settings. This parameter allows you to map MIDI program numbers to specific presets.

XXX MAP TO XXX

Step 6 The number on the left of the display is the MIDI program number (or the number sent via a MIDI footswitch, etc.). Use the PARAMETER SELECT control to select the number (1-128) to be mapped to a preset.



MIDI program number (1-128)

Step 7 The number on the right of the display is the preset number to map to (or the preset number that will be recalled when the MIDI program number on the left is sent). Use the PARAMETER ADJUST control to select the preset number (1-160, or OFF) to map to.

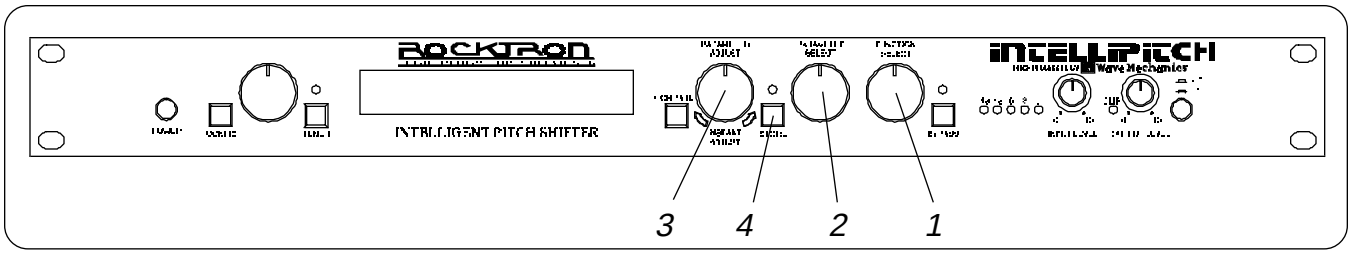
Preset number (1-160, OFF)

Step 8 Press the STORE button after each MIDI program number and preset number have been selected to save the change for each mapping. "STORED" will flash briefly on the display.

The Program Mapping function may be exited by turning either the PRESET or FUNCTION SELECT control. Only the changes that have been stored will be saved after exiting the Program Mapping function.

C. MIDI Channel

The MIDI Channel function determines the MIDI channel that the Intellipitch receives MIDI commands on.



Step 1 Turn the FUNCTION SELECT control to "MIDI Channel".

** MIDI CHANNEL **

Step 2 Turn the PARAMETER SELECT to view the current MIDI Channel.

MIDI CHANL	OMNI

Step 3 Use the PARAMETER ADJUST control to select the MIDI channel that the Intellipitch is to receive MIDI commands on. Channels 1-16, OMNI (all channels), or OFF (will not receive MIDI commands) may be selected.

MIDI CHANL	10

Step 4 Press the STORE button to save the new MIDI channel status. "STORED" will briefly flash on the display.

STORED

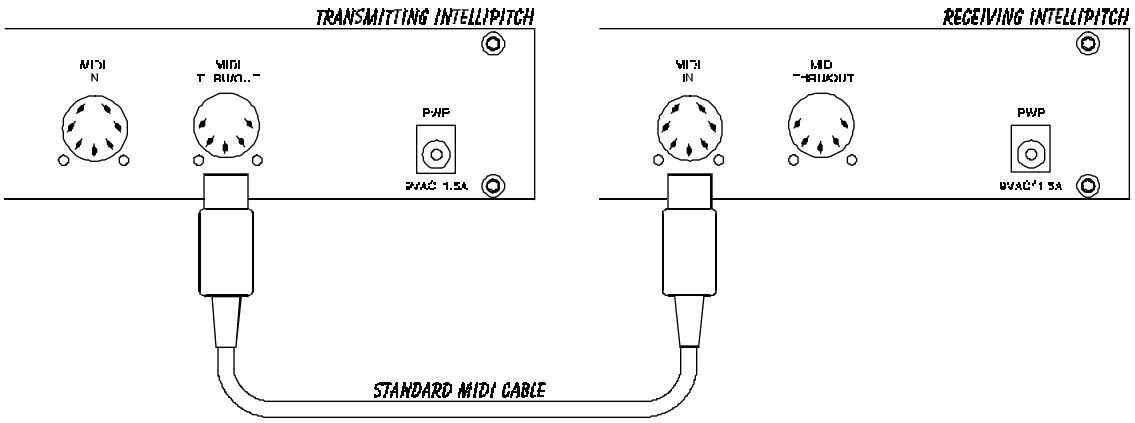
To exit the MIDI Channel function, turn either the PRESET or FUNCTION SELECT control. Any changes made must be stored to be saved after exiting the MIDI Channel function.

D. MIDI Dump/Load

Any or all of the Intellipitch user presets may be dumped to a sequencer or another Intellipitch via system exclusive messages. The information exchanged when performing a MIDI dump consists of the configuration type, parameter values, title characters and controller assignment/limit information. When dumping a single Intellipitch preset into another Intellipitch, the preset being dumped may be loaded into any user preset location on the receiving Intellipitch.

Dumping a single Intellipitch user preset into another Intellipitch:

Step 1 Using a standard MIDI cable, connect the MIDI OUT of the transmitting Intellipitch to the MIDI IN of the receiving Intellipitch. Do **not** connect the other MIDI ports together.



Step 2 Turn the FUNCTION SELECT knob on both units to "MIDI Dump/Load".

MIDI DUMP/LOAD

Step 3 Turn the PARAMETER SELECT knob on the transmitting Intellipitch to "Preset Dump". (The current preset number will also be displayed.)

54 PRESET DUMP

Step 4 Turn the PARAMETER SELECT control on the receiving Intellipitch to "Preset Load". (The current preset number will also be displayed.)

78 PRESET LOAD

Step 5 Use the PRESET control on the transmitting Intellipitch to select the preset you wish to dump. Any of the user presets (1-80) may be dumped.

17 PRESET DUMP

Step 6 Use the PRESET control on the receiving Intellipitch to select the preset location to store the received preset. The preset currently at this location will be overwritten, therefore use caution when selecting the preset location to dump to.

25 PRESET LOAD

Step 7 Press the STORE button on the transmitting Intellipitch to initiate the dump. The transmitting Intellipitch will display the preset number of the preset dumped and "DUMPED". The receiving Intellipitch will display the preset location being stored to and "RECEIVING..." while it receives and stores the preset's parameters, title and controller information.

After all information for that preset is stored, the receiving Intellipitch will display "LOADED" and the preset number. The receiving Intellipitch also recalls the loaded preset at this time so that it may be verified.

17 DUMPED

Transmitting Intellipitch

25 LOADED

Receiving Intellipitch

The following information is transmitted when a preset dump is initiated:

F0H - Start of Exclusive byte
00H - Manufacturer ID byte 1
00H - Manufacturer ID byte 2
29H - Manufacturer ID byte 3
02H - Product ID byte
28H - Command byte, Preset dump

XXH - 200 data bytes, (MSB=0)

YYH - Check Sum byte, ("Exclusive or" of data bytes, MSB=0)
F7H - End of Exclusive byte

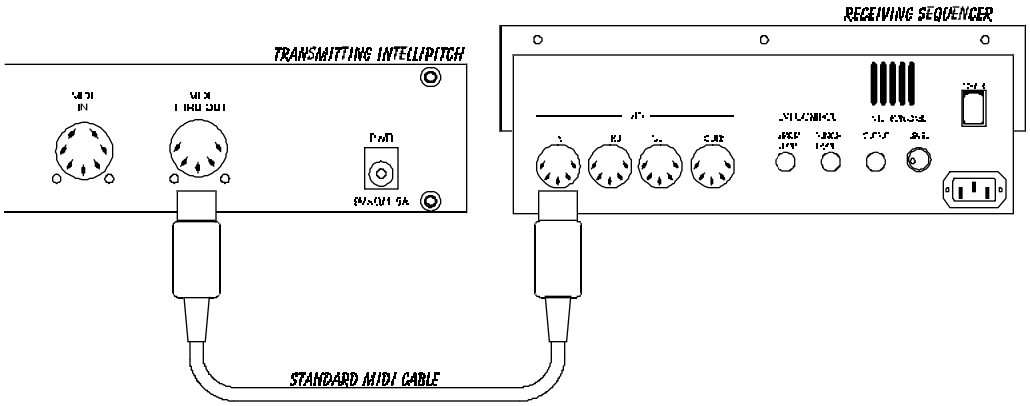
Each data byte is a 7-bit value. The first transmitted data byte consists of the lower 7 bits of the first value. The second transmitted data byte consists of the most significant bit of the first value. These two transmitted bytes are combined when received to form the first value. The next two transmitted bytes will form the next value in the same way and so on, until all 200 bytes are transmitted. The order of data byte transmission is as follows:

55 Parameter values X 2 =	110 transmitted bytes
13 Title characters X 2 =	26 transmitted bytes
32 Control Assignments X 2 =	64 transmitted bytes
	200 total transmitted data bytes

The Check Sum byte is the "Exclusive Or" operation of all the data bytes, with the most significant bit = 0.

Dumping the Intellipitch user memory into a sequencer:

Step 1 Connect the MIDI OUT of the Intellipitch to the MIDI IN on the sequencer using a standard MIDI cable.



Step 2 Turn the FUNCTION SELECT control on the Intellipitch to the "MIDI DUMP/LOAD" function. This function is available at the most clockwise position of the FUNCTION SELECT control in all user presets.

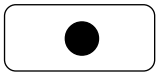
MIDI DUMP/LOAD

Step 3 Turn the PARAMETER SELECT control to the "DUMP USER DATA" position.

DUMP USER DATA

Step 4 Start the sequencer recording.

RECORD



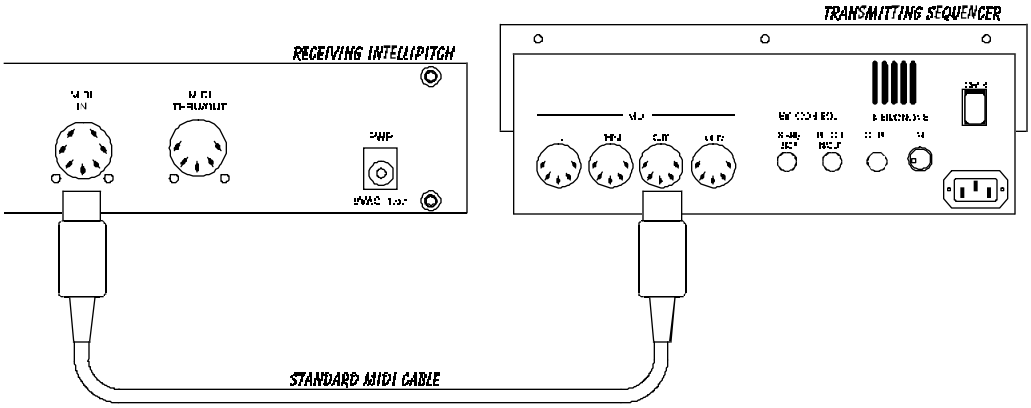
Step 5 Press the STORE button on the Intellipitch to initiate the user data dump. The Intellipitch will display the number of the data string as it is dumped. Data strings 1-80 are the user presets as described by the preset dump function, while data string 81 is the program mappings. Data string 82 contains the footswitch types, MIDI channel, mapping status, and "power on" preset. After all the user data is transmitted, the Intellipitch will display "USER DATA DUMPED". The process takes approximately 3 minutes to complete.

USER DATA DUMPED

After the Intellipitch displays "USER DATA DUMPED", stop the sequencer. The sequencer should have recorded all of the data. Keep the data stored on a disk and kept in a safe place.

Reloading the user memory from a sequencer:

Step 1 Connect the MIDI OUT of the sequencer to the MIDI IN on the Intellipitch with a standard MIDI cable.



Step 2 Turn the FUNCTION SELECT control on the Intellipitch fully clockwise to the "MIDI DUMP/ LOAD" position.

MIDI DUMP LOAD

Step 3 Turn the PARAMETER SELECT control to the "LOAD USER DATA" position. The Intellipitch is now ready to receive the user data from the sequencer.

LOAD USER DATA

Step 4 Play back the user data previously recorded on the sequencer. The Intellipitch will display the data strings as it is storing them. The data string and "LOADED" will appear on the display. After all the user data has been loaded the Intellipitch will display "USER DATA LOADED". The entire procedure will take approximately 3 minutes to complete.

USER DATA LOADED

Do not play back data from the sequencer faster than it was recorded, as errors may occur. Errors may also occur if any knob is turned or any button is pressed before the message "USER DATA LOADED" appears.

The following information is transmitted when a user data dump is initiated:

F0H - Start of Exclusive byte
00H - Manufacturer ID byte 1
00H - Manufacturer ID byte 2
29H - Manufacturer ID byte 3
02H - Product ID byte
2AH - Command byte, Start of user dump, 2BH continue user dump.

XXH - 200 data bytes for 80 stfings, 256 data bytes for string 81, 12 data bytes for string 82, MSB = 0

YYH - Check Sum byte, ("Exciusive Or" of data bytes, MSB=0)
F7H - End of Exclusive byte

The first 80 data strings are very similar to a preset dump data string except for the command byte. The first data string for a user data dump will contain the command byte 2AH. The following data strings will contain the command byte 2BH. Data string 81, which is the program mapping, will contain 256 data bytes. Data string 82, which is miscellaneous data, will contain 12 data bytes.

Dump/Load Error Messages

"RECEIVE ERROR" - This message will appear on a receiving Intellipitch if Check Sum bytes do not match, or if a status byte (MSB = 1) is received when a data byte was expected. This message also appears if a knob is turned or a button is pressed during reception. This message also appears if System Exclusive strings are sent too fast, without a long enough pause between strings.

"DUMP ERROR" - This message will appear if MIDI Data is received at the MIDI IN while dumping is in progress.

"XMEM ERROR" - This message will appear if received data can not be verified after it is stored.

E. Factory Restore

This procedure allows you to restore the Intellipitch memory to its original condition as it was shipped from Rocktron.

! ! CAUTION ! !

This procedure will permanently erase all user presets and replace them with the original factory presets as shipped from the factory. If you have stored presets which you do not want to lose, make a record of all parameter values before performing the *Factory Restore* procedure.

Step 1 From any preset, turn the FUNCTION SELECT control clockwise to the last available function - "Factory Restore".

FACTORY RESTORE

Step 2 Turn the PARAMETER SELECT control clockwise to display the only parameter for this function. The Intellipitch will display "Enter Code 0".

ENTER CODE 0

Step 3 Turn the PARAMETER ADJUST control to select the number "249". Note that the only number which can be entered to perform the restore function is 249. Entering any other number will immediately exit this function and return to the previously recalled preset number and title.

ENTER CODE 249

Step 4 **Pressing the STORE button at this time *will erase all user presets and replace them with the factory presets!*** Press the STORE button to initiate the Factory Restore function. The Intellipitch will display "INITIALIZING".

INITIALIZING

After the initialization process is complete, the display should read "ERRORS 0". The "0" represents the number of bytes that the Intellipitch found did not initialize properly. Any other message indicates that the Intellipitch may not have reinitialized properly. The Intellipitch will remain in this condition until either the PRESET or FUNCTION SELECT control is turned. Preset #160 is active after completion of the Factory Restore function.

ERRORS 0

10. Appendix

A. MIDI Implementation Chart

Date: September 19, 1997 Model: Intellipitch Version: 1.0

	FUNCTION	TRANSMITTED	RECOGNIZED	REMARKS
Basic Channel	DEFAULT CHANGED	1-16 1-16	1 -16 1-16	May be saved in nonvolatile memory
Mode	DEFAULT MESSAGES ALTERED	X X X	X X X	
Note Number	TRUE VOICE	X	X	
Velocity	NOTE ON NOTE OFF	X X	X X	
After Touch	KEY'S CHANNEL	X X	X X	
Pitch Bend		X	X	
Control Change**		X	O	
Program Change*	TRUE NUMBER	X	O	
System Exclusive		O	O	
System Common	SONG POSITION SONG SELECT TUNE REQUEST	X X X	X X X	For User Memory Dump/Load and Preset Dump/ Load.
System Real Time	CLOCK COMMANDS	X X	X X	
Aux. Messages	LOCAL ON/OFF ALL NOTES OFF ACTIVE SENSING SYSTEM RESET	X X X X	X X X X	

O=YES / X=NO

NOTES * ACTUAL MIDI PROGRAM VALUE SENT IS 0-127, CORRESPONDING TO PRESETS 1-128. OPTIONAL IMPLEMENTATION OF PROGRAM MAPPING ALSO AVAILABLE.

** EIGHT DIFFERENT PARAMETERS MAY BE CHOSEN FROM EACH USER PRESET AND ASSIGNED A CONTROL NUMBER. THE CONTROL NUMBER MAY BE FROM 0-120, OR "OFF". AN UPPER AND LOWER RANGE MAY ALSO BE SPECIFIEDFOR EACH PARAMETER.

B. Specifications

MEASUREMENT			*CONDITIONS*
Maximum Input:	+20dBu		Input Level Pot minimum
Maximum Output:	+20dBu		Output Level Pot maximum
Nominal Input Range: (16dB Headroom)	+4dBu to -21dBu		Input Level Pot minimum Input Level Pot maximum
Input Impedance:	470Kohms		
Output Impedance:	120 ohms		
Dynamic Range:	104dB HUSH In, 94dB HUSH Out		Peak Signal/A weighted Noise Floor, Direct Level = +6dB, Direct Post HUSH Effects Level= - ∞
THD + N:	.009%		1KHz, -5dB input level 22Hz to 22KHz Bandwidth Direct Post HUSH, Direct Level = +6dB, Effects Level = -∞
Dry Frequency Response:	10Hz to 100KHz 10Hz to 30KHz	+.25, -1.5dB ±.25dB	
Wet Frequency Response:	10Hzto 18KHz 20Hz to 17KHz	+.5, -3dB ±.5dB	

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