DigiTech

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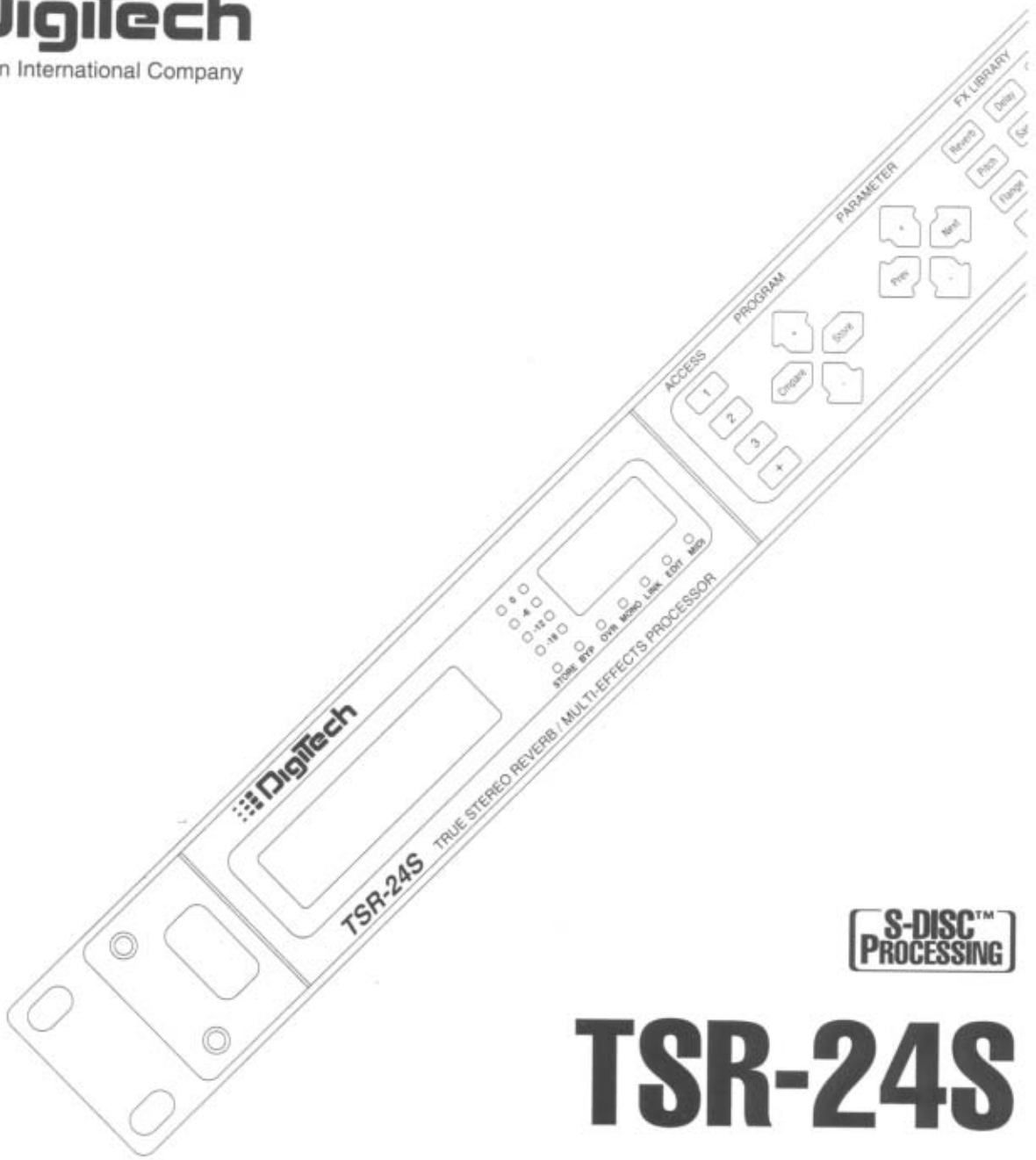


S-DISC™ PROCESSING

TSR-24S

True Stereo Reverb / Multi-Effects Processor

Owner's Manual

Introduction

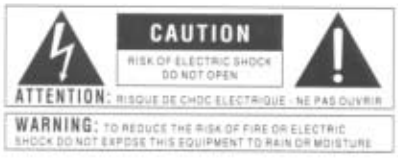
Congratulations, and thank you for your purchase of the DigiTech TSR-24S True Stereo Digital Multi-Effects System. The revolutionary TSR-24S is the future of studio effects processing, offering total flexibility and control of the best digital effects in the industry. Special features of the TSR-24S include

- Full bandwidth effects (20-20kHz)
- 24-bit signal path, 48-bit internal data transmission
- True stereo processing with multiple input/output routing configurations (stereo in, quad out; mono in, quad out; dual mono in, dual stereo out; etc.)
- Any effect can appear at any point in the effects chain
- Number of effects limited only by the number of available CPU and RAM blocks in the unit
- Fully programmable and assignable input/output routing and mixing
- Programmable effects algorithms allow the user to create an unlimited variety of custom effects configurations
- Programmable redundant effects in an effects chain, e.g., EQ + flange + EQ + pitch shift + pitch shift
- Instant Module and Parameter access
- Multiple modulating effect capability (e.g., chorus + flange+ pitch shift)
- Expandable memory for sampler and delay effects and increased processing power with optional PPC (Parallel Processing Card)
- Built-in MIDI merging (MIDI output can act as a standard out or as a merged out)
- MIDI Transmit and Receive mapping
- MIDI activity LED indicator
- All effects and Parameters available for MIDI continuous control
- Data wheel for quick menu scrolling and Parameter entry

For the first time, all of your effects needs can be filled by a single unit with unsurpassed 24-bit digital clarity. The TSR-24S enables you to choose the effects you want and put them in the order you want. A single TSR-24S can also act as two discrete processing units, handling two fully independent audio lines simultaneously.

This owner's manual is your key to understanding the powerful world of the TSR-24S. Read it carefully. After you've had time to familiarize yourself with the unit, try experimenting with unusual effects combinations or routings. You might achieve some interesting results. DigiTech is always looking for new sounds and ideas, so if you feel that you've created something unique, send us your ideas to the address on the back cover of this manual. Who knows? Your idea may be in the next release! Good luck, and thank you for choosing DigiTech.

Safety Precautions



The symbols shown at left are internationally accepted symbols that warn of potential hazards with electrical products. The lightning flash with an arrowpoint in an equilateral triangle means that there are dangerous voltages present within the unit. The exclamation point in an equilateral triangle indicates that it is necessary for the user to refer to the owner's manual.

These symbols warn that there are no user serviceable parts inside the unit. Do not open the unit. Do not attempt to service the unit yourself. Refer all servicing to qualified personnel. Opening the chassis for any reason will void the manufacturer's warranty. Do not get the TSR-24S wet. If liquid is spilled on the unit, shut it off immediately and take it to a dealer for service. Disconnect the equipment during storms to prevent damage.

U.K. ONLY - A moulded mains plug that has been cut off from the cord is unsafe. Discard the mains plug at a suitable disposal facility. NEVER UNDER ANY CIRCUMSTANCES SHOULD YOU INSERT A DAMAGED OR CUT MAINS PLUG INTO A 13 AMP POWER SOCKET.

Do not use the mains plug without the fuse cover in place. Replacement fuse covers can be obtained from your local retailer. Replacement fuses are 13 amps and MUST be ASTA approved to BS1362.

Lithium Battery Warning

CAUTION! This product contains a lithium battery. There is danger of explosion if battery is incorrectly replaced. Replace only with an Eveready CR 2032 or equivalent. Make sure the battery is installed with the correct polarity. Discard used batteries according to manufacturer's instructions.

ADVARSEL! Lithiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

ADVARSEL! Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri av samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

VAROITUS! Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

VARNING! Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

Warranty

1. The warranty registration card must be mailed within ten days after purchase date to validate this warranty.

2. DigiTech warrants this product, when used solely within the U.S., to be free from defects in materials and workmanship under normal use and service.

3. DigiTech liability under this warranty is limited to repairing or replacing defective materials that show evidence of defect, provided the product is returned to DigiTech WITH RETURN AUTHORIZATION, where all parts and labor will be covered up to a period of one year. A Return Authorization number may be obtained from DigiTech by telephone. The company shall not be liable for any consequential damage as a result of the product's use in any circuit or assembly.

4. Proof-of-purchase is considered to be the burden of the consumer.

5. DigiTech reserves the right to make changes in design or make additions to or improvements upon this product without incurring any obligation to install the same on products previously manufactured.

6. The foregoing is in lieu of all other warranties, expressed or implied, and DigiTech neither assumes nor authorizes any person to assume for it any obligation or liability in connection with the sale of this product. In no event shall DigiTech or its dealers be liable for special or consequential damages or from any delay in the performance of this warranty due to causes beyond their control.

The information contained in this manual is subject to change at any time without notification. Some information contained in this manual may also be inaccurate due to undocumented changes in the product or operating system since this version of the manual was completed. The information contained in this version of the owner's manual supersedes all previous versions.

Section 1 - Startup

Power and Grounding Information

Line Conditioning - The TSR-24S, as with any piece of computer hardware, is sensitive to voltage drops, spikes, and surges. Interference such as lightning or power "brownouts" can seriously, and in extreme cases, permanently damage the circuitry inside the unit. Here are some ways to avoid this type of damage:

- Spike/Surge Suppressors - This is an inexpensive solution to all but the most severe AC line conditions. Surge protected power strips usually cost only slightly more than unprotected strips, making them a worthy investment for protecting your valuable gear.

- AC Line Conditioners - This is the best protection from improper line voltages, but it is more expensive. Line conditioners constantly monitor for excessively high or low voltages and adjust the voltage accordingly, thus delivering consistent power levels.

Front Panel Controls and Functions

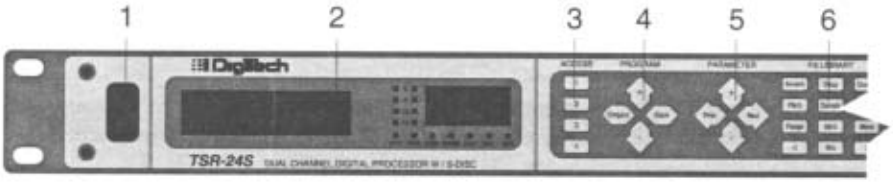


Fig. 1-1 The Front Panel

The front panel controls and functions of the TSR-24S are as follows (refer to figure 1-1):

1) **Power Switch** - This turns the unit on or off.

2) **Display Window** - The display window shows current operating and programming information and is comprised of several parts: the LCD display, the input level meters (one for each input channel), the Program number indicator window and a series of mode and status indicator LEDs. The LCD display shows Program names, Parameters and Parameter values and is the communication interface between you and the TSR-24S. The input-level meters monitor the level of the incoming signal, allowing proper adjustment of each channel's input level control. In the Program number indicator window, you will see the currently selected Program number. This changes as you scroll through the available Programs. The mode and status LEDs indicate the following:

   - Store indicator - When lit, this LED indicates that changes have been made in the Program and that the Program needs to be stored in order to keep the changes.

   - Bypass indicator - Indicates (when lit) that all effects have been bypassed. Either the Bypass button or a footswitch connected to the rear panel Footswitch jack can bypass the unit. To exit bypass mode, press the Bypass button on the front panel.

   - Overload indicator - Indicates digital information overflow in the unit's microprocessor. When lit, distortion may be heard in the output signal. The guideline for this indicator is **let your ears be the judge**. If this indicator lights occasionally and no audible distortion is present, ignore it. If distortion is audible in the output signal, turn down one or more of the internal digital effects levels of the Program to eliminate the problem.

- Mono Indicator - When lit, this LED indicates that the currently selected Program is designed to be used in a Mono configuration and might sound different when the unit is connected for stereo operation. When this LED is lit, the signal at the left input is routed to both the left and right outputs at the Master Mix control.

- Link Indicator - Indicates (when lit) that you have entered the Algorithm Link (audio routing) mode. This LED remains lit until you have finished Linking effects modules and exited the Link mode. Effects are bypassed when the TSR-24S is in Link mode.

- Edit Indicator - Indicates (when lit) that you are in Algorithm Edit mode. This LED lights when performing operations such as adding or deleting effects modules from an Algorithm or when naming an Algorithm. The Edit LED and the Link LED can both be lit at the same time.

- MIDI Activity Indicator - Indicates (when lit) that MIDI data is being transmitted or received. It is normal for this indicator to flicker intermittently when the TSR-24S is connected to other MIDI devices.

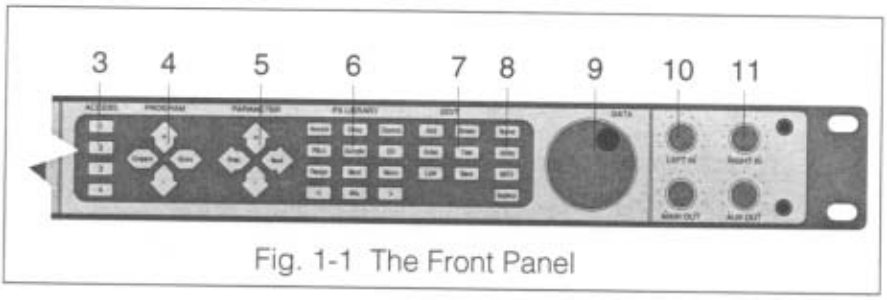


Fig. 1-1 The Front Panel

3) **Access Buttons** - These are programmable, special function buttons that can be assigned to do different things in different modes. For instance, they can be used to jump directly to the most frequently-used Parameters of a Program, as shortcut keys in the Algorithm and Program naming modes, or as submenu guides in the Utility and MIDI menus. For more information on this group of buttons, see Section 3, pg. 19.

4) **Program Buttons** - The <+> and <-> Program buttons allow you to scroll through TSR-24S effects Programs. The <STORE> button stores a Program in memory for later recall and is used with the Store indicator LED in the display window. The <COMPARE> button compares an edited Program with the original version.

5) **Parameter Buttons** - The <NEXT> and <PREVious> Parameter buttons allow access to all the Parameters of the currently selected Program. When the Parameter you want to edit has been reached, use the Parameter <+> and <-> buttons to change the value of the selected Parameter.

6) **FX Library** - These buttons allow you to jump directly to the first Parameter of Modules in an Algorithm or insert different effects types into an effects Algorithm. The buttons in this group are <REVERB>, <DELAY>, <CHORUS>, <PITCH shift>, <SAMPLE>, <EQ>, <FLANGE>, <MODulation>, <MORE>, and <MIX>. Also included in this section are the <<> and <>> buttons, which allow you to skip directly to the first Parameter of each effect in the Algorithm.

7) **Edit Buttons** - Buttons in the Edit group are for creating or modifying Algorithms on the TSR-24S. The Edit buttons include <ADD>, <DELETE>, <ENTER>, <TEST>, <LINK>, and <SAVE>. For more on this group of buttons, see Section 3.

8) **Global Buttons** - These buttons perform global functions, including those required for naming Programs and Algorithms, MIDI setups (including transmit and receive maps), and utility functions such as LCD contrast and footswitch setup. Buttons in this group are <NAME>, <UTILITY>, <MIDI>, and <BYPASS>.

9) **Data Wheel** - The Data wheel is a multifunctional control to quickly scroll through Programs, Algorithms, and Parameter values. Its function depends on the TSR-24S's current mode of operation. If you're in Performance mode, turning the Data wheel clockwise will increment through the Programs in memory. Turning the wheel counterclockwise will decrement through Programs in memory (just like using the Program <+> and <-> keys). The Data wheel works similarly in other modes of operation.

10) **Input Level Controls** - This adjusts the level of the sound source(s) fed to the TSR-24S. For best performance, set these controls so that the "0" LEDs on the input meters light occasionally. If these controls are set too high, you may hear unwanted distortion in the output signal.

11) **Output Level Controls** - These control the overall output level of the TSR-24S. Each Output Level knob controls a *pair* of outputs. *Individual* channel output levels can be set from within each Program.

Rear Panel Connections

Fig. 1-3. The TSR-24S Rear Panel

The TSR-24S can be configured several different ways to optimize the unit's performance in many types of applications. For this reason, it is important to have the TSR-24S's rear panel connected in a way that is consistent with the intended use. For example, suppose you want to use the TSR-24S as a mono input/stereo output reverb and delay device for vocals and you have created several Programs that fit your needs. If the unit is wired for mono in/mono out operation, your Programs might not sound right. **To simplify operation, always be sure the rear panel is connected in a way that is consistent with the intended use.** Because of the flexibility of the TSR-24S architecture, it is possible to configure the unit in the following ways: mono in/mono out, mono in/stereo out, mono in/quad out, stereo in/mono out, stereo in/stereo out, stereo in/quad out, and any 3 out combination of any of type. The TSR-24S rear panel connectors and functions are as follows:

1) **Left Input (1)** - This is the Channel 1 source input. For mono applications, either the Channel 1 or Channel 2 input can be used. **When using this input for mono applications, be sure that the Program(s) and Algorithms you use are set up to treat the Channel 1 input as the audio source.**

2) **Right Input (2)** - This is the Channel 2 source input. For mono applications, either the Channel 1 or Channel 2 input can be used. **When using this input for mono applications, be sure that the Program(s) and Algorithms you use are set up to treat the Channel 2 input as the audio source.**

3) **Main Outputs** - These are the main audio outputs of the TSR-24S. Use these outputs when Programs and Algorithms are set up to use these outputs in a stereo output configuration. However, all four outputs are completely independent and can be used in any configuration you want. The Master mix control effects these outputs only.

4) **Auxiliary Outputs** - These are the auxiliary audio outputs of the TSR-24S. These should be used when more than 2-channels of audio output are desired, or when using the unit in a dual stereo output configuration. Remember, all four outputs are completely independent and can be used in any configuration. The Master mix control does not affect these outputs.

5) **Footswitch Jack** - The optional DigiTech FS-300 footswitch or an external switching device connects here.

6) **MIDI In Port** - The MIDI In port allows the TSR-24S to respond to incoming MIDI messages, including Program Change, Continuous Control, and System Exclusive data.

7) **MIDI Out Port** - This sends out MIDI data generated by the TSR-24S to other devices and is a fully merged MIDI Thru port, capable of combining any incoming MIDI data with MIDI data generated by the TSR-24S **without the need for an external merge box**. This feature can be turned on or off in the MIDI menu.

8) **MIDI Thru Port** - This jack sends the same MIDI data input to the MIDI In Port.

9) **AC Line Input** - This is the power cord receptacle.

MIDI and Audio Routing Setups

Following are examples of MIDI and audio routings the TSR-24S is capable of. Remember that in each example, different Program types (mono in, stereo out, etc.) must be used in order for the TSR-24S to sound right.

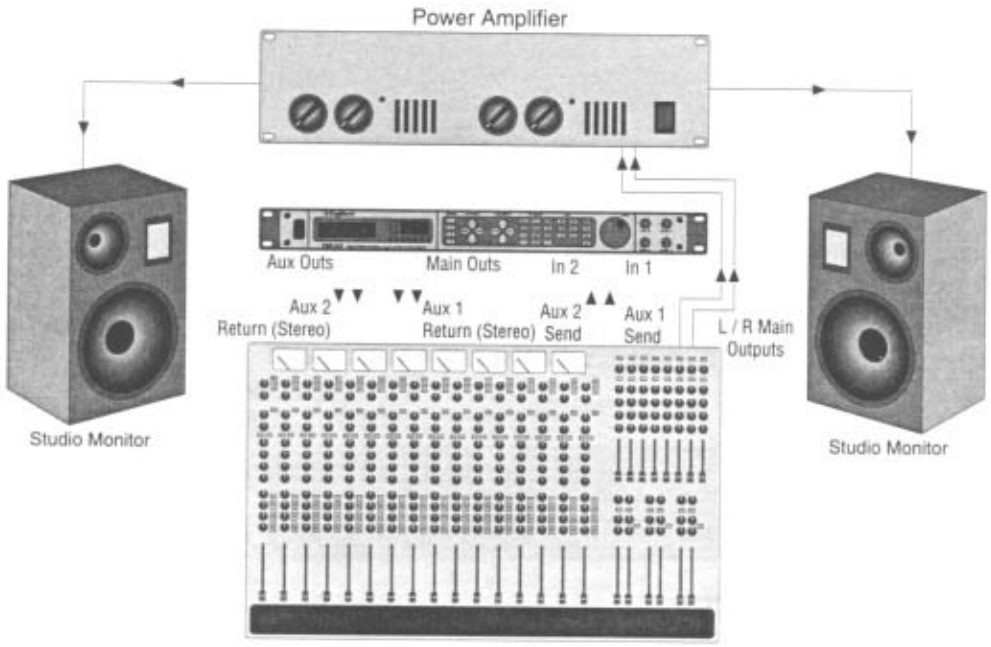


Fig. 1-4. Using the TSR-24S as Two Independent Effect Devices (dual mono in / dual stereo out)

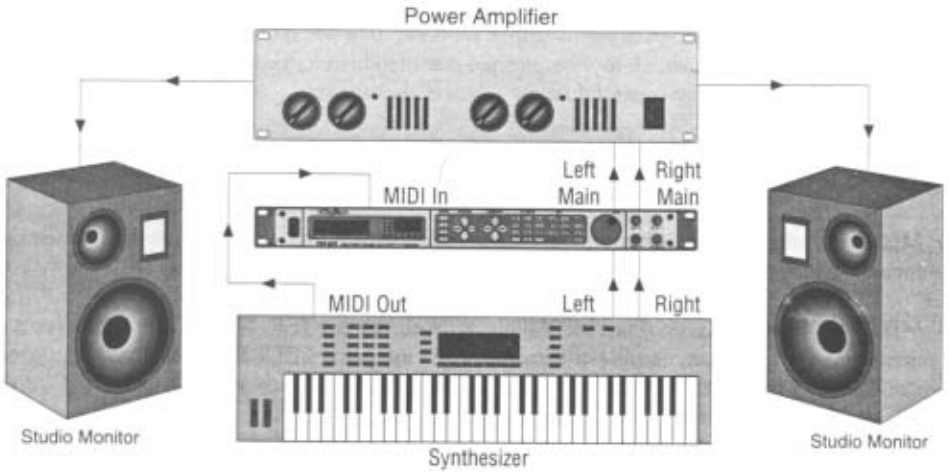


Fig. 1-5. Using the TSR-24S as a Single In-line Effects Device (stereo in / stereo out)

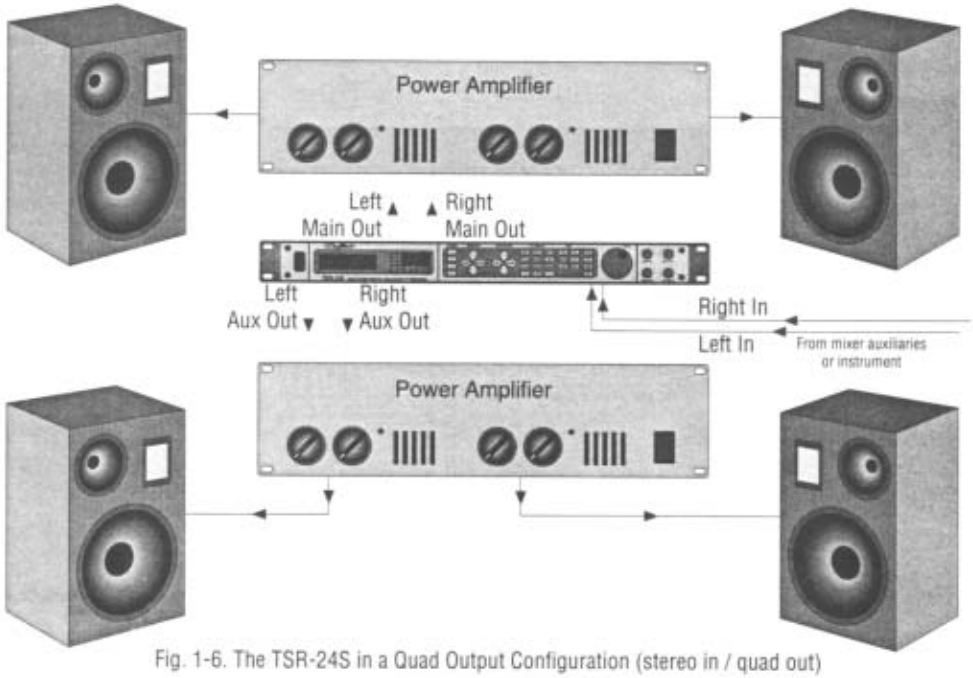


Fig. 1-6. The TSR-24S in a Quad Output Configuration (stereo in / quad out)

Section 2 - Basic Operations

Input/Output Configurations

The flexibility of the TSR-24S's audio routing system allows the unit to be used in several different configurations. This provides extraordinary processing versatility. Possible operating configurations for the unit are shown in figure 2-1.

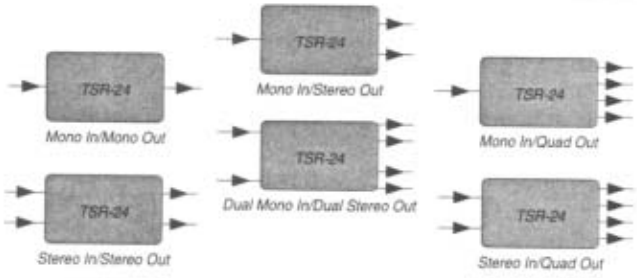


Fig. 2-1 TSR-24S Input/Output Configurations

NOTE: It is possible for the TSR-24S to act as two completely independent effects units using Dual Mono In configurations. Because of the unique way in which the TSR-24S operates, any variations on the routings shown (including 3 out combinations) are also possible.

It is important for the rear panel of the TSR-24S to be connected in a manner that is consistent with the intended use. For instance, if the unit is connected in a Mono In/Stereo Out configuration, Programs that were created using a Stereo In/Quad Out configuration may sound different. In order to duplicate previous sounds, it may be necessary to repatch.

Menu Architecture

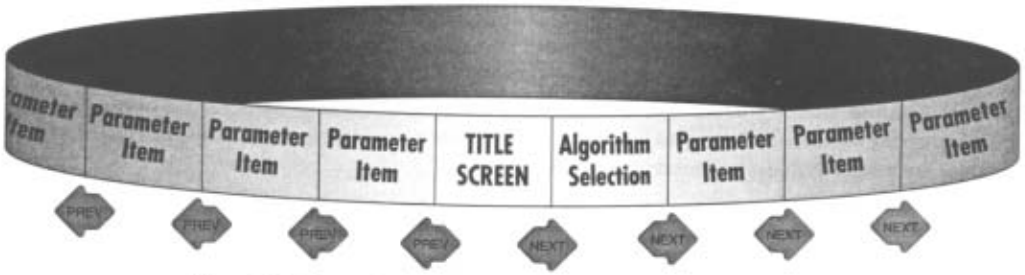


Fig. 2-2 Linear Parameter Architecture of a Program

The menu architecture of the TSR-24S has been designed to be a linear series of items rather than a multiple-level menu. In other words, instead of including several submenus or levels under a single Parameter heading, all Parameters and functions are included in a single level and are accessed using the Parameter <NEXT> and <PREV> keys, or the Access keys. This makes access to specific Parameters of a Program or Algorithm quick and easy (especially when using the Access keys) and provides a much clearer picture of exactly where you are in the menu.

Figure 2-2 shows the linear arrangement of the menus in the TSR-24S. Notice that if you press the Parameter <NEXT> key from the last item in the list (the Parameter item to the left of the title screen), the display jumps, or wraps around to, the first item in the menu (in this case, the title screen).

Likewise, if the Parameter <PREVious> button is pressed in Program mode, the display will wrap to the last Parameter in the list. This wraparound menu feature is provided so that Parameters near the end of a long list of items can be reached as easily as items at the beginning of the menu. If you press and hold either the Parameter <PREV> key or the Parameter <NEXT> key, the TSR-24S will begin scrolling at high speed through the available Parameters in the menu.

About Performance Mode

The TSR-24S's default mode after power-up is called Performance mode. This is the main operating mode of the TSR-24S during normal use. From this mode, any of the operating Parameters or modes (except Edit mode) can be reached easily. Edit mode is protected due to the nature of the TSR-24S's Program and Algorithm architecture.

Program and Algorithm Architecture

For a Program to function, it must have an Algorithm assignment. In simplest terms, an Algorithm is a set of ordered instructions that tells the TSR-24S what functions to perform. Each Algorithm is unique and plays an integral role in the Program structure of the TSR-24S.

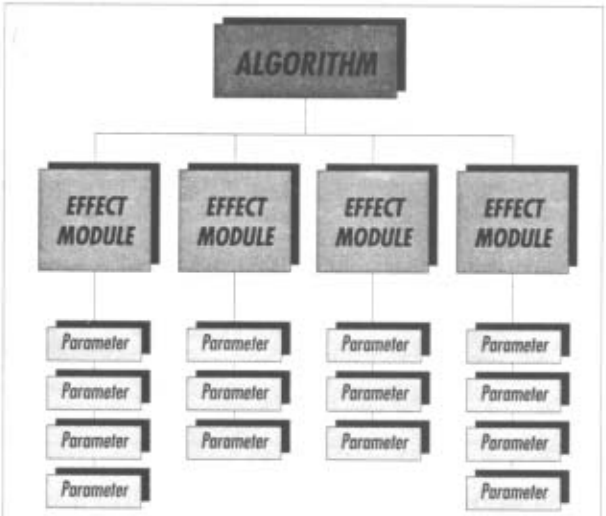


Fig. 2-3 The anatomy of an Algorithm

An Algorithm consists of a group of single-purpose effects called FX Modules (see fig. 2-3). Each Module contains its own set of Parameters and is designed to perform a specific function as efficiently as possible. The full power of the TSR-24S lies in the individual Modules and their ability to be used in groups or to stand alone. When combined in groups, virtually any imaginable effects combination and routing is possible.

Algorithms have the signal path information that tells the TSR-24S how to transport the signal from the inputs, through the Modules, and to the outputs. Programs, on the other hand, contain information about the conditions under which the Algorithm will operate, such as mix percentages, effect levels, Program titles, and the values associated with each Parameter of each Module.

It is easy to think of Programs and Algorithms in terms of a cake recipe. An Algorithm can be thought of as the container for the raw materials for making the cake (flour, sugar, eggs, etc.), while the Program tells how much of each ingredient to use. In either case, one is useless without the other.

However, those same ingredients for a cake (in different quantities) have other uses besides cake-making, so it is important to have these different amounts shown in a different recipe. Likewise, an Algorithm complete with its Modules can be used as the basic sound for more than one Program, since it is the Program that determines the values for each Parameter in the Algorithm.

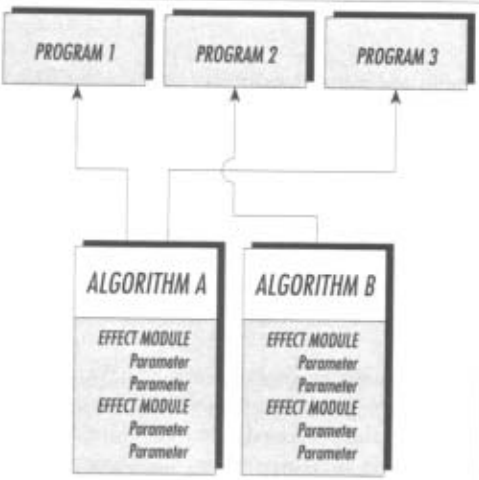


Fig. 2-4 Assigning Algorithms to Programs

Figure. 2-4 shows an example of two different Algorithms assigned among three Programs.

Notice that Algorithm A is assigned to both Programs 1 and 3, while Algorithm B is assigned to Program 2 only. (Using a single Algorithm for more than one Program is common since Programs with the same effects Modules and routings as other Programs are often needed, but with slightly different Parameter settings for each effect.)

For example, suppose Algorithm A contains a reverb, a chorus, and a flanger, and that you want to replace the reverb with a multi-tap delay. Since Algorithm A is used by more than one Program, modifying the Algorithm might cause both Programs 1 *and* 3 to change. On a larger scale, imagine what would happen if 25 or 30 Programs used the same Algorithm, and you were allowed to modify it. The results could be disastrous.

Fortunately, the TSR-24S does not allow mistakes of this kind. Instead, you will be informed that the Algorithm is already in use, and you will be asked to give a name to a new Algorithm. This is a safety feature that keeps all your Programs (and your sanity) intact.

Let's refer back to the example in figure 2-4. If you wanted to modify Algorithm B, you *would* be allowed to do so, but only because the Algorithm is used by a single Program. The same is true of Algorithms that aren't used by any Programs. Only under these conditions will the TSR-24S allow modification of existing Algorithms. Modification attempts under any other circumstances will be deferred to a new Algorithm. Specific procedures for these operations are covered in more detail in Section 3.

Accessing Factory Programs

You can recall factory Programs using the front panel or via MIDI (MIDI functions are covered in section 3). To change programs using the Program <+> and <-> buttons or the Data wheel, do the following:

- While in Performance mode, press the Program <+> button. Notice that the Program shown in the display changes and the number shown in the LED display increments by one each time the Program <+> button is pressed. Pressing the Program <-> button causes the reverse to occur: the TSR-24S decrements through the Programs in memory. To scroll at high speed through the Programs in memory, press and hold either the Program <+> or Program <-> button.

- Turn the Data wheel. This allows you to scroll through available Programs at any speed you want. Note that turning the Data wheel clockwise increments through the Programs, while turning the wheel counterclockwise decrements through the Programs. The Data wheel can be used in this manner to perform nearly any operation on the TSR-24S.

Section 3 - Programming the TSR-24S

This section covers all the information needed to create, assemble and store Algorithms and Programs with the TSR-24S. Read it carefully.

Memory Usage

There are several types of memory that we'll be referring to in this section, so let's begin by grouping these different memory types into two specific groups. The first type of memory is called Program memory. All Programs, both user and factory, are stored in Program memory. Program memory is independent of all other memory in the TSR-24S and is used exclusively for Program storage.

The second section of memory, called Algorithm memory, can be further broken down into two separate areas: RAM and CPU memory. It is easy to think of CPU memory as the processing power available to each Algorithm, while RAM memory is the space used to temporarily store the processed data. Together, RAM and CPU memory make up the total amount of memory space available to an Algorithm. Let's examine the memory structure of Algorithms.

About Modules and Memory

An Algorithm is made up of individual effects, called Modules. Each Module requires a certain amount of processing power (CPU) and memory (RAM) to perform the effect's functions. These memory quantities are measured in small chunks, called "blocks." The TSR-24S contains 256 RAM blocks and 256 CPU blocks that are available to whatever Algorithm is in use.

> **IMPORTANT:** When you start building your own Algorithms, remember that the TSR-24S's system software requires about 28 CPU blocks for the master mix control and miscellaneous input and output routing. This gives you a working total of about 228 CPU blocks to work with (484 CPU blocks on a PPC-200 equipped TSR-24S).

Different Modules require different quantities of each memory type. Suppose, for example, that you want to create an Algorithm that contains a 2-second delay, a 6-band EQ, a chorus, and a reverb. Since delays require more RAM space than CPU space, a 2-second delay may require only 7 CPU blocks, but as many as 100 RAM blocks. If you were to create an Algorithm containing just this delay, you would be left with around 249 available CPU blocks and 156 available RAM blocks.

A 6-band EQ, on the other hand, may require about 51 processing blocks and practically no memory. The space requirements for an EQ, then, can be translated into: 51 CPU blocks and 0 RAM blocks. When you add this EQ to the Algorithm containing the 2-second delay, you are left with 165 available CPU blocks and 162 available RAM blocks.

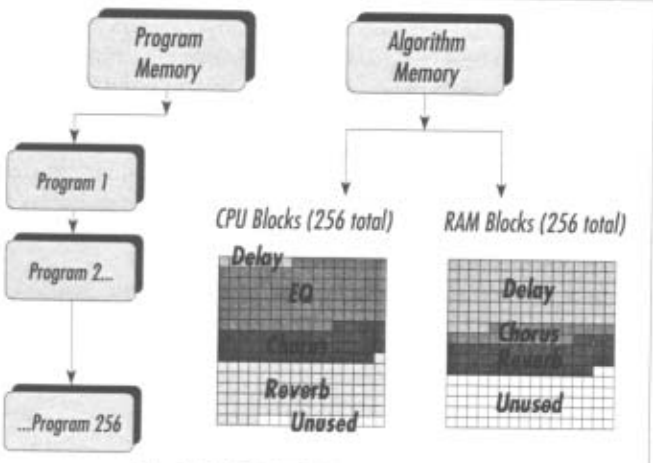


Fig. 3-1 TSR-24S Memory Allocation

Chorus Modules may require about 50 CPU and 10 RAM blocks, but since we only need one, there should be plenty of space for a small reverb. After adding the chorus to the Algorithm, you are left with 115 CPU and 152 RAM blocks.

To finish the Algorithm, you would need to find a reverb that fits into the available memory space. A reverb that requires 69 CPU blocks and 30 RAM blocks would leave you about 46 unused CPU blocks and 122 unused RAM blocks. After all the Modules have been added to the Algorithm, the memory divisions would look something like Fig. 3-1.

NOTE: You don't need to use all 256 RAM and CPU blocks in each Algorithm. Unused space is ignored by the TSR-24S. In addition, the total number of blocks needed for an Algorithm will always exceed the sum of the blocks used by the Modules because a few blocks are always used for system processing.

Modifying Factory Programs

After you have had time to become familiar with the TSR-24S, you may find that there are several factory Programs that are very close to the sound you're looking for, but that need a few small tweaks to make them perfect. Let's suppose you want to use Program 2, which has a 400 millisecond 2-tap delay with a chorus and a reverb. To work in your application, it needs to have a 1.125 second delay. Let's use this factory Program as an example for Program modification. (If you have changed the factory settings, the settings in this example will not match yours. However, the modification procedure is the same.) The procedure is as follows:

- Scroll to Program 2 (from Performance mode) using the Program <+> and <-> buttons or the Data wheel. The display reads:

```
Killer Chorus
8 Voice Chorus
```

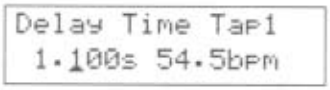
- Scroll to the Delay Time Parameter using the Parameter <NEXT> and <PREV> keys. The display reads:

```
Delay Time Tap1
( 0.400s 150bpm)
```

Note that a cursor appears under the 4.

IMPORTANT: Delay Time Parameters in the TSR-24S can be edited in two different ranges to give the most flexibility and accuracy in the least amount of scrolling time. In this example, the cursor appears under the 4 in 0.400. The 4 is in the *hundred milliseconds* position. In other words, if you press the Parameter <+> key when the cursor is in this position, you will increase the delay time by 100 milliseconds. If you press the Parameter <NEXT> key, the cursor will move to the third position to the right of the decimal point, or in the *milliseconds* position. Each time you press the Parameter <+> button from this position, the delay time will increase in single millisecond steps. This method of ranging allows you to scroll rapidly to large-value delay times without having to wait for the unit to scroll in single millisecond steps.

- Scroll upward (using the Parameter <+> key or the Data wheel) until both the *seconds'* position (to the left of the decimal point) and the hundred milliseconds' position show 1's, that is, the delay time shown in the display reads:



- Press the Parameter <NEXT> key. The cursor appears in the milliseconds position.

- Using the Parameter <+> key or the Data wheel, scroll upward until the last two digits of the delay time read 25. The delay time is now set at 1.125 seconds.

When you make changes to the Parameters, the STORE light in the display window goes on. This means that if you want to save any of your changes, you will have to store them. If you change Programs at this point, either through MIDI or using the front panel buttons, any modifications made to the Program will be lost. The procedure for storing Programs is covered in Section 3, pg. 18.

Basic Program Creation

There are several requirements for creating a Program on the TSR-24S. First, an Algorithm needs to be assigned to the Program. Second, Parameters must be modified to your liking, and third, the Program must be stored in memory so it can be recalled.

Selecting an Algorithm

The Algorithm you choose for a Program determines the basic function of the Program. Therefore, it is necessary to choose an Algorithm that contains all the Modules you want to use in an appropriate configuration. The Algorithm selection screen for all Programs in the TSR-24S is one screen to the right of the title screen.

The Algorithm selection screen works with the LED display to show other information about the Algorithm. When the Algorithm selection screen is selected, push the Parameter <+> or <-> key or turn the Data wheel and the LED display shows the number of the Algorithm and whether the currently selected Algorithm is a factory Algorithm or a User Algorithm. Factory Algorithms are indicated by an "F" in the LED display followed by a number. User Algorithms are indicated by a "U" in the LED display followed by a number. To select an Algorithm for a Program, do the following:

- From the title screen, press the Parameter <NEXT> key once. This is the Algorithm selection screen. The name of the currently selected Algorithm is shown on the top line of the display, and the bottom line shows the Modules in the Algorithm. Push the the <+> or <-> key or turn the Data wheel and the LED display shows either a "U" (User Algorithm) or an "F" (Factory Algorithm), followed by the number of the Algorithm.

NOTE: When there are more Module names in the Algorithm than will fit on a single line of the display, an arrow will appear in the first or last character of the display. These arrows indicate that there is more information about the Modules than could be displayed on a single screen. To see the remaining information, press the Parameter <NEXT> or <PREV> key (depending on the arrow direction indicated in the display).

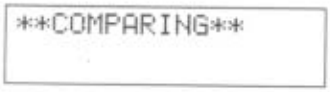
- Use the Parameter <+> and <-> keys to select the Algorithm you want to use with the Program. Note that when you change the Algorithm, the Store LED lights. This indicates that the Program must be stored to retain the changes you've made to the Program. See pg. 18 for storing procedures.

Once you have selected the Algorithm you want to use, you can begin modifying the Parameters to suit your purpose.

Comparing Programs

The <COMPARE> button allows you to compare a modified Program with the original without losing the modifications you have made. This feature makes differences between Programs clear and provides an easy reference point for creating new Programs.

To compare a modified Program with the original, press the <COMPARE> button. The TSR-24S will temporarily switch to the original Program settings, and the display will read:



Now you can hear what the original Program sounds like. Press the <COMPARE> button again to switch back to the edited version.

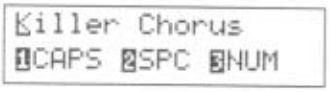
This operation can be performed as many times as you want, but be sure to exit Compare mode after you are finished. The TSR-24S will not respond to any buttons or commands while in Compare mode.

Naming Programs

The TSR-24S allows you to give your Programs custom names up to 16 characters in length. The naming procedure uses the Parameter <+> and <-> keys, the Access keys and the Data wheel to make Program naming quick and easy. Access key <1> changes the character from upper to lower case and back. Access key <2> inserts a space into the Program name, and Access key <3> switches you to the numbers section of the character set.

To give a Program a custom name, do the following:

- Press the <NAME> button. The display shows the current Program name with a cursor under the first character of the name. It will look something like this:



  The blocked numbers preceding each option indicate the Access key that will perform the function shown.

- Use the Parameter <+> and <-> keys or the Data wheel to scroll to the character you want to use.

- Press one of the Access keys to switch between Caps, Spaces, and Numbers.

- Press the Parameter <NEXT> key when you have selected the character you want. Note that the cursor moves to the next character. Repeat this procedure until the Program name is shown the way you like.

- Press the <NAME> button again once you have a name for the Program that you like. This will take you out of the Program naming mode and back to Performance mode. Note that the Store LED is now lit. This means that you must store the changes you have made in order for your custom name to be retained in memory.

Unique to the TSR-24S naming process are several *special* naming functions. The Program <COMPARE> and <STORE> buttons allow you to bump an entire name or section of a name either left or right in one-space increments. The procedure is as follows:

- Use the Parameter <NEXT> and <PREV> keys while in Name mode to place the cursor underneath the character to be moved.

- Press the Program <COMPARE> or <STORE> buttons to move all the characters to the right of the cursor either left or right.

The Program <+> key copies the character above the cursor into memory. This allows you to place a copy of that character (using the Program <-> key) anywhere in the name. The procedure is as follows:

- Use the Parameter <NEXT> and <PREV> keys while in Name mode to place the cursor under the character to be copied.
- Press the Program <+> key. The selected character is copied into memory.

- Move the cursor to where you want to put the copy and press the Program <-> key. Note that a copy of the character appears in the location you selected.

Storing and Copying Programs

In order for modified Programs to be available for later recall, you must store them in memory. This is done with the <STORE> button. After you have made all the necessary modifications to the Program, do the following:

- Press the <STORE> button. The display reads:

```
Save Chgs To:  2
Killer Chorus
```

NOTE: The Program number defaults to the number and name of the current program.

- Scroll to the Program number you want to store the new Program in using the Program <+> and <-> buttons or the Data wheel.

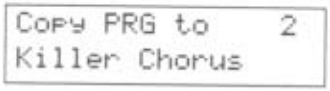
- To store the Program, press the <STORE> button again. The display will briefly read:

```
***Storing***
```

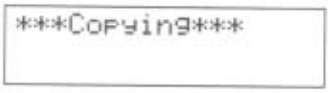
after which you will be returned to the mode you were in when you pressed <STORE>. To abort the command, press <COMPARE>.

The Store function can also be used to copy Programs from one memory location to another. If no changes have been made in the selected Program, do the following:

- Press the <STORE> button. The display will look something like this:



- Select the memory location you want to place a copy of the selected Program in with the Program <+> and <-> keys or the Data wheel and press <STORE> again. The display will briefly read:



You are returned to the mode you were in when you pressed <STORE> the first time. To abort the command, press <COMPARE>.

Using the Access Keys

The four Access keys are user-programmable buttons that allow you to quickly access up to four of your most commonly used Parameters within a Program. A good example of their use is Parameter tweaking for live performances where conditions vary slightly from night to night.

For example, if in-tempo delays are used on program material, you could set up an Access key to instantly jump to the delay time Parameter so you can start tweaking. This puts you in a position to begin making adjustments right away, instead of fumbling with buttons and knobs and scrolling through unrelated Parameters trying to get to your delay time Parameter. These keys can also be useful when specific Parameters need minor adjustments to compensate for venue changes, room acoustics and equalization.

Access keys can be programmed to jump to any Parameter you want, and there is no limit to the number of times they can be reprogrammed. However, Access key assignments need to be saved with the Program in order to be retained in memory. See pg. 18 for information on saving a Program.

Suppose you are using a stereo chorus and that you want to assign Access key <1> to jump to the chorus speed Parameter. The procedure is as follows:

- Scroll to CHORUS SPEED using the Parameter <NEXT> and <PREV> keys.

- Press and hold Access key <1> for about two seconds. After a short pause, a number 1 inside a black box will appear in the upper right-hand corner of the display. The number inside the box indicates the Access key number that has been assigned to that Parameter.

If you decide that you want to change the Access key assignment for that Parameter, simply repeat the process using the desired Access key. If you want to leave the Parameter with no Access key assignments, press and hold its assigned Access button again, and the Access key will be disconnected from the Parameter.

This press-and-hold procedure works with any of the Access keys, but remember that only four Parameters can have an Access key assignment per Program. After you've made your Access key assignments, store the Program in order to retain the changes.

The special characters used to indicate Access key assignments are as follows:

 Indicates that Access key <1> has been assigned to the Parameter shown in the display.

 Indicates that Access key <2> has been assigned to the Parameter shown in the display.

 Indicates that Access key <3> has been assigned to the Parameter shown in the display.

 Indicates that Access key <4> has been assigned to the Parameter shown in the display.

Access keys are also used in the Program and Algorithm naming processes and in the Utility menu for option selection. See pg. 17 for Program and Algorithm naming procedures. See pg. 52 for more on the Utility Menu.

More Special Characters

There are several special characters that the TSR-24S uses to tell you at a glance exactly what it is doing. Most special characters in the TSR-24S are in inverted type, that is, reversed out of a black background, and they usually appear in the upper right-hand corner of the display. There are instances, however, when they appear somewhere other than in the upper right-hand corner or when more than one special character appears in the display.

Some of these characters are graphic representations of the input/output configurations and give information about how Algorithms are routed (1 input/2 outputs, etc.). For these, input lines are on the left half of the character and outputs are on the right half.

Letters A-F are used in Algorithms where two or more effects Modules have the same name. This is an instance in which a special character will immediately follow the Module name rather than appear in the corner of the display. Following is a list of all the TSR-24S special characters and their meanings.

 This indicates that a MIDI Continuous Controller is linked to the Parameter.

 Characters from this group are used for distinguishing between Modules of the same name in a single Algorithm.

 This character tells you that the currently selected Algorithm is linked in a 1 input/1 output configuration (mono in/out). Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 1 input/2 output configuration. This can denote either a mono in/stereo out or a mono in/dual mono out configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 1 input/3 output configuration. This can denote either a mono in/1 mono, 1 stereo out or a mono in/3 mono out configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 1 input/4 output configuration. This can denote either a mono in/dual stereo out or a mono in/quad out configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 2 input/1 output configuration. This can denote either a stereo in/mono out or a dual mono in/mono out configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 2 input/2 output configuration. This can denote either a dual mono in/out configuration or a true stereo configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 2 input/3 output configuration. This can denote dual mono in/1 true stereo, 1 mono out *or* dual mono in/3 mono out *or* a true stereo input/1 true stereo, 1 mono out *or* true stereo in/3 mono out configuration. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

 Algorithm is linked in a 2 input/4 output configuration. This can denote dual mono in/dual true stereo out; dual mono in/4 mono out; dual mono in/quad out; true stereo in/2 true stereo out; true stereo in/4 mono out; true stereo in/quad out. Also indicates the number of inputs and outputs in individual Modules in Edit Mode.

Using the FX Library Keys

The FX Library keys are used to jump to specific places in the menus. For example, if a Program contains several delays and you want to change the delay time on only one of them, you could press the <DELAY> library button from anywhere in the Parameter menu and you would jump to the first Parameter of the next delay in the Algorithm. Press the button again, and you would be taken to the first Parameter of the next delay in the Algorithm, and so on.

Likewise, when adding or deleting Modules from an Algorithm (in edit mode), press the library key associated with the Module you want to add or delete, and the TSR-24S will jump to the appropriate group of Modules. Simply continue pressing the appropriate Library key until the Module you want is shown in the display.

Using the <TEST Button>

The <TEST> button allows you to listen to individual effects Modules by themselves. The Parameter settings for the TSR-24S <TEST> sounds are basic, general-use sound settings only and have a 50:50 wet/dry mix.

To listen to an individual effect Module, do the following:

- Press the <TEST> button while in Performance mode. The display reads:

```
Select module to
 TEST
```

- Use the FX Library keys to select the Module you want to hear. The display shows the current Module being auditioned and the test message. It will look something like this:

```
GigaVerb          
****  Test  ****
```

- To select another Module from the same group (e.g., Gigaverb, Bigverb, and MFX reverbs are all in the <REVERB> library), press the same library button until the Module you want to test is shown in the display.

- To exit the Test mode, press the <TEST> button or the Parameter <+> button. You are returned to the screen that you were on when the <TEST> button was first pressed.

NOTE: Test is not available for all Modules.

Basic Algorithm Creation

The easiest way to create an Algorithm can be reduced to four simple steps:

1. Decide which Modules you want in the Algorithm This is the first and most important step when creating a new Algorithm. This process is simply a matter of deciding what types of sounds you want to create.

2. Decide how you want the Algorithm to be connected. We recommend that you sit down with a pencil and paper and draw out the effects routings that you want for each Module. This creates a simplified block diagram of the input/output scheme that you can use as a guide for setting up the routings in the TSR-24S. Pages 72 through 79 show all the routings of all the factory Algorithms in the TSR-24S. Use them as guidelines to help you create your own custom Algorithms.

3. Add the Modules to a new Algorithm.

4. Link and Save the Algorithm.

To illustrate, let's suppose that you want to create a dual mono input/dual stereo output Algorithm that contains a stereo chorus, a stereo reverb, and a 2-tap digital delay. Further, suppose that you want the left channel signal to exit in stereo from the Main outputs, and that you want the right channel to exit in stereo from the Auxiliary outputs.

It sounds complicated, but once you get it down on paper, it makes sense. A diagram of the imaginary Algorithm just described looks like figure 3-2.

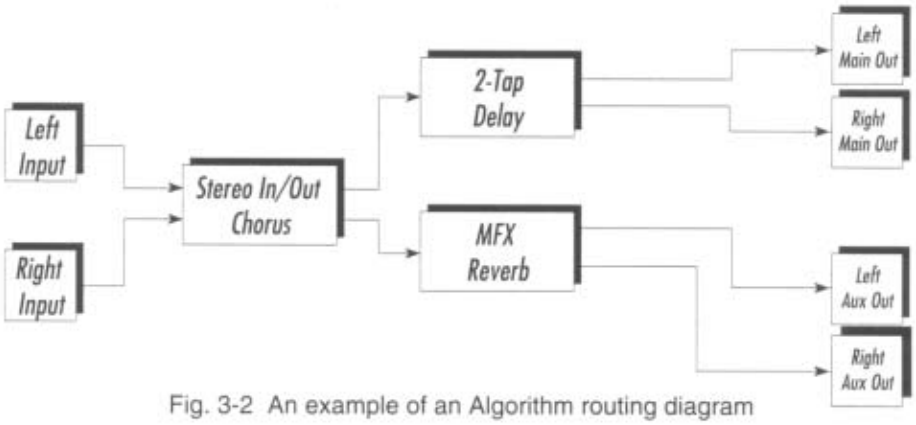


Fig. 3-2 An example of an Algorithm routing diagram

The left and right inputs and outputs referred to in this diagram represent the inputs and outputs of the TSR-24S. If you follow the signal through the diagram, you will notice that there are two completely separate paths to the outputs. From the Main outputs you would hear a signal with chorus and digital delay (in that order), while from the Auxiliary outputs, you would hear chorus and reverb (also in that order).

The next step is to add the effects Modules to the Algorithm and link them.

Adding Effects Modules

Adding effects Modules to an Algorithm is like placing a group of objects on a table for later use. They are not arranged in any specific way (although you can use AutoLink™ if Modules are added to the Algorithm in an order that reflects the way they will be routed), and there are no inputs or outputs connected. Once all the Modules that you want to use have been added, you can begin the Linking process.

However, there are a few conditions that will prevent you from making changes to *existing* Algorithms. For instance, if an existing Algorithm is used by more than one Program, you will only be allowed to *temporarily* add or delete effects Modules to and from the Algorithm. Permanent changes to the Algorithm can only be saved as a new Algorithm that contains all the elements of the Algorithm you modified originally. This safety feature prevents you from accidentally modifying Programs by making changes to their assigned Algorithms.

The TSR-24S *will* allow changes to be saved to an existing User Algorithm if it is used by only one Program, but modification attempts under any other circumstances will be deferred to a new Algorithm.

To add effects Modules to an Algorithm, you must first enter Edit mode. Edit mode is reached by scrolling to the Algorithm screen (one screen to the right of Performance mode) and pressing the <ENTER> or <ADD> button.

> **IMPORTANT:** Do not confuse Edit mode with the mode in which Parameter values are modified. The term "Edit mode" is used **exclusively** when referring to Algorithm editing. Changing Parameter values is called "Program modification."

To add effects Modules to an Algorithm, start from the title screen and do the following:

- Switch to Edit mode by scrolling to the Algorithm screen (one screen to the right of the title screen) and pressing the <ADD> button once. The Edit LED lights and the display reads:

```
1Modify Alg
2New Alg    4Exit
```

- Specify whether you want to modify the currently selected Algorithm or create a new Algorithm by pressing the appropriate Access key. The display reads:

```
Select Fx to ADD
1Show Alg 4Exit
```

- Select the effect Module that you want to add to the Algorithm using the FX Library keys or the Parameter <PREV> and <NEXT> keys.

- Press <ENTER> to add the Module to the Algorithm. The display briefly reads:

```
Module Added
Successfully
```

and then

```
Select Fx to ADD
1Show Alg 9Exit
```

- Continue adding Modules by selecting the Module and pressing <ENTER>. If there is not enough memory for the Module, the display will look something like this:

```
ADD:(Won t fit)
BigVerb          1
```

Deleting Effects Modules

The <DELETE> key allows you to delete all the Modules from an Algorithm, to delete a single Module from an Algorithm, and to delete an entire Algorithm from memory. When deleting Modules or Algorithms, you are bound by the same conditions as those for adding Modules. You may only save or overwrite user Algorithms that are used by only one Program.

To delete *individual* Modules from an Algorithm:

- Switch from Performance to Edit mode by scrolling to the Algorithm screen (one screen to the right of the title screen) and pressing the <ADD> button.

- Press the <DELETE> button. The display reads:

```
Select Fx to DEL
1Show Alg 9Exit
```

- Using the Parameter <NEXT> and <PREV> keys or the FX Library keys, select the effect Module that you want to delete from the Algorithm. The top line of the display reads DEL: followed by the abbreviated Module name. The bottom line shows the full Module name.

- To delete the Module shown in the display, press <ENTER>. The display briefly reads

```
Module Deleted
Successfully
```

and then shows

```
Select Fx to ADD
1Show Alg 9Exit
```

- Repeat the procedure to delete another Module.

- Press Access key <4> to exit. The display reads:

```
Save Changes ?
1Yes 2Edit 3Exit
```

- Press Access key <1> to save the changes you made to the Algorithm. To exit Edit mode without saving the changes, press Access key <4>. To return to Edit mode, press Access key <2>.

It is also possible to delete all the existing Modules from the Algorithm without deleting the *entire* Algorithm. This allows you to start from scratch with empty RAM and CPU memory. The procedure is as follows:

To delete all Modules from an Algorithm:

- Press <ADD> to enter Edit mode from the Algorithm screen (one screen to the right of the title screen).

- Press and hold the <DELETE> button until the display reads:

```
**Deleting all**
**   MODULES    **
```

- Release the <DELETE> key. The display reads:

```
Select Fx to ADD
1Show Alg 3Exit
```

At this point, you have successfully cleared out all the Modules associated with the Algorithm you're editing, leaving you free to begin building a new Algorithm.

To delete an Entire Algorithm:

> **WARNING!** This procedure deletes an Algorithm permanently and all Programs that use the Algorithm will be lost and replaced with the original factory Program.

- Scroll to the Algorithm screen (one screen to the right of the title screen). The display shows the name of the Algorithm on the top line and the Modules in the Algorithm on the bottom line.

- Press the <DELETE> key. The display reads:

```
Delete Alg?
1Yes 2No 3Exit
```

- To delete the Algorithm from memory, press Access key <1>. The display briefly reads PROGS USING ALG WILL BE LOST and then shows

```
Are you sure?
1Yes 2No
```

- Press Access button <1> to delete the Algorithm. The display briefly reads:

```
***DELETING***
***ALGORITHM**
```

To abort, press Access key <2>.

NOTE: You cannot delete factory Algorithms. This is a safety feature that prevents you from destroying the factory presets.

Show Algorithm

You can change the order of the Modules in the display by pressing Access key <1>, SHOW ALG, while in Edit mode. The TSR-24S places the Module names in the display in the order they were added, regardless of the way they are linked. Changing the order in the display can help you remember the linking order of the Modules. However, changing the display has no effect on the way Modules are linked.

For example, suppose you have an Algorithm with reverb and chorus. To change the order of the Modules in the Algorithm display, do the following:

- While in Edit mode, press Access key <1> to show the contents of the Algorithm. The display looks something like:

```
↑Move        ■Exit
■Vrb Cho
```

- Press <NEXT> to place the cursor under the "C" in CHO.
- Press the Parameter <+> key. The chorus module disappears and MOVE is replaced with DROP.

```
↓Drop        ■Exit
MVrb _
```

- Press <PREV> to place the cursor under the "M" in MVRB.
- Press the Parameter <-> key. The chorus Module reappears in front of the reverb Module:

```
↑Move        ■Exit
Cho MVrb
```

- Press Access key <4> to exit the SHOW ALG screen.

Linking (Audio Path Routing)

After you have added all the Modules that you want to use, the next step is to connect the inputs and outputs of each Module to the other Modules or to the TSR-24S inputs and outputs. The linking process itself is similar to connecting patch cables between discrete effects devices; that is, you are connecting outputs to inputs. There are four conditions that govern the capabilities of the Link mode. They are as follows:

- Outputs can be connected to any number of inputs without using mixer Modules.

- Inputs can be connected to only one output. If you want to connect more than one output to a single input, you must use a mixer Module in your Algorithm. Using this method, any number of outputs can be connected to a single input.

- You are always connecting outputs to inputs, much the same as if you were connecting a series of discrete effects boxes.

- The left side of the display always shows where the connection is coming *from*, and the right side of the display shows what the item on the left is currently connected *to*. The center section of the display is reserved for graphic representations of the current connection.

It sounds a bit complicated at first, but once you sit down and try it, you'll see that it's simple. The easiest way to get the routing you want can be reduced to three simple steps:

1. Add the Modules in the order you want them routed.

2. Use AutoLink™. In most cases, if your Modules are ordered correctly, AutoLink™ takes care of everything and there is nothing left to do but Save the new Algorithm.

3. Double-check your routings to make sure they are correct. If necessary, manually Link (or re-Link) the connections you want (e.g. AutoLink™ does not affect the Auxiliary outputs).

To illustrate the simplicity of the Linking process, let's create an Algorithm that contains a dual chorus and a stereo delay and that you want to link them with the chorus first followed by the delay. Further, let's connect the outputs of the chorus directly to the TSR-24S's Auxiliary outputs.

First, diagram the Algorithm so that you have a reference point for the routing that you want to accomplish. A diagram of the Algorithm is shown in figure 3-3. The procedure is as follows:

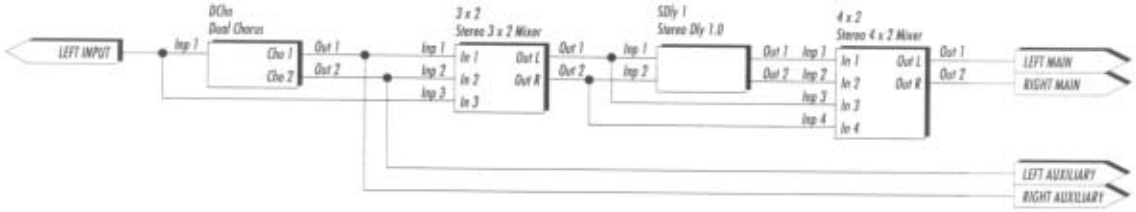


Fig. 3-3. Linking Example

- After you've added the Modules in the appropriate order (in this example, add the chorus first, the 3x2 mixer second, the delay third, and the 4x2 mixer last), press <LINK>. The display reads:

```
Link FX outputs
to FX inputs
```

then

```
Edit link list
then press SAVE
```

and finally,

```
AutoLink ?
1Yes  2No
```

- Enter YES by pressing Access button <1>. The display reads:

```
|Input|F...|DCho |
|Left |  |INP 1|
```

If you scroll manually through the Links using the <NEXT> and <PREV> keys, you will notice that AutoLink™ did its job exactly like we wanted, except that the Auxiliary outputs are still not connected. This is where manual Linking comes in, and it is just as easy. To manually connect the Auxiliary outputs, continue from the last screen and do the following:

- Using the <NEXT> and <PREV> keys, scroll to the screen that reads:

```
|No   | 3Aux  |
|Link |  |Left |
```

- Press the Parameter <-> button three times. The left side of the display changes to read:

```
|DCho |F...3Aux  |
|OUT 1|  |Left |
```

Output 1 of the dual chorus is connected to Auxiliary output 1.

- Press <NEXT>. The display reads:

```
|No   | 3Aux  |
|Link |  |Right|
```

- Press the Parameter <-> button four times. The left side of the display changes to read:

```
|DCho |F...3Aux  |
|OUT 2|  |Right|
```

The Algorithm is now correctly Linked as shown in fig. 3-3. Remember that when you use AutoLink™, each Module output is linked to the closest input from the previous Module. When you become familiar with the Linking process, you will be able to predict exactly how AutoLink™ will link your Modules.

To retain the changes you've made, you must save the Algorithm.

Saving an Algorithm

When the Modules of an Algorithm are linked, you must save the Algorithm to keep your changes. This is done with the <SAVE> button (in the Edit section of the front panel). You must be in Link mode to save Algorithms.

IMPORTANT: Do not confuse the <SAVE> button (in the Edit section of the front panel) with the <STORE> button (in the Program section of the front panel). The <SAVE> button is used **only** for saving Algorithms to memory. The <STORE> button is for storing Program modifications.

To save an Algorithm, do the following:

- In Link mode, press the <SAVE> button. If you chose the MODIFY ALG option when you first entered Edit mode, the display will briefly read:

  ```
  Algorithm name
  already in use
  ```

  after which you are placed in Name mode. If you chose NEW ALG when you first entered Edit mode, you'll go straight to Name mode.

- Give the Algorithm a new name (using the naming instructions found on pg. 18) and press the <SAVE> key again. The display briefly reads:

  ```
  **** SAVING ****
  ****   ALG   ****
  ```

  and you are returned to Performance mode.

The Algorithm is now saved in memory for use with Programs. When the you exit to Performance mode after an Algorithm saving procedure, the TSR-24S will automatically select that Algorithm for use in the Program that you are returned to.

Section 4 - The FX Library

The FX Library contains all the effects Modules that are available for use in Algorithms. Most of these Modules appear in more than one input/output configuration to accommodate different setups and applications. The following tables show specific Modules and their abbreviated library names broken down into individual categories.

Reverbs

Module Name	Module Abbrv.	Description
ExaVerb	Exa	Best for treated environments (halls, studio rooms)
VeraVerb	Vera	Great for unnatural sounds
GigaVerb	Gig	Best for real acoustic spaces
GigaVerb+	Gig+	GigaVerb with 1-band parametric EQ
BigVerb	Big	High-quality reverb
MFX Reverb	MVerb	For use in multi-effects Algorithms
Stereo Gigaverb	SGig	True stereo professional studio reverb
Stereo Big Rvrb	SBig	True stereo high-quality reverb

The TSR-24S offers 4 different professional studio-quality reverb Modules: GigaVerb, GigaVerb+, ExaVerb, and VeraVerb. All four Modules require almost all the RAM and CPU resources for an entire S-DISC, although there may be room for one other small Module (such as a Silencer™).

ExaVerb gives you 22 Parameters for precise room simulations, plus extensive equalization and response contouring control. ExaVerb sounds best when it is used to simulate acoustically treated room spaces, such as a concert chambers or halls, studio rooms, and listening rooms. ExaVerb has 2 inputs and 3 outputs. Input 2 and output 3 on both VeraVerb and ExaVerb are reserved for stereo blend functions. They are not used for transmission of the main audio path through the Module. The BLEND control allows you to more accurately reproduce real room response to events as you would hear them if you were standing in the simulated room. See diagram of factory Algorithm #30 on pg. 79 to see how it works.

VeraVerb is a band-split version of ExaVerb with separate controls for high- and low-frequency reverberations plus three-band EQ with shelving high and low for each range. VeraVerb makes great unnatural reverberations like springs and plates and otherworldly acoustic spaces.

Fig. 4-1 shows a simplified diagram of the capabilities of VeraVerb. As you can see, it includes a 3-way crossover system in its controls. This allows you to exactly tailor the response curves of your reverberation and gives you control of three distinct areas: the amplitude of each frequency range, the crossover points for each frequency range, and whether the ranges overlap in the crossover zone.

Examples of VeraVerb's flexibility include setting BASS REVERB FREQ and MID REVERB FREQ far enough apart to cause a gap in the midrange frequency response of the reverberations or using full-frequency overlapping crossover points (e.g. MID REVERB FREQ set at 20 Hz and BASS REVERB FREQ set at 20 kHz) to increase the smoothness of the reverberation beyond what is normally available. Different variations of these methods can be used to emphasize or smooth out specific portions of the reverberation frequency response.

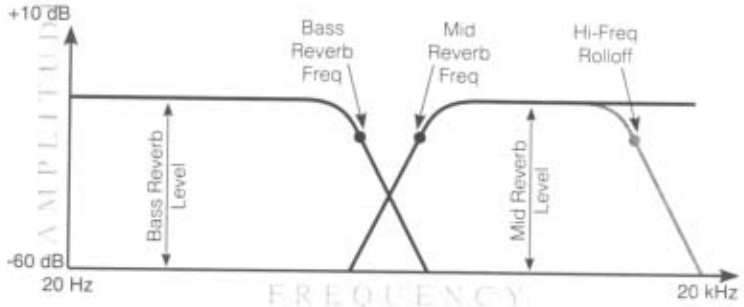


Fig. 4-1 Diagram of VeriVerb

Gigaverb has 20 Parameters, and, like the rest of the reverbs in the TSR-24S, it gives exceptional soundfield and tonal shaping control over reverberation. It is best suited for simulating natural room environments that have no acoustic treatment, like churches and assembly halls. A one input/four output Module, Gigaverb is capable of producing reverberation of virtually any size, shape, depth, timbre or soundfield location. GigaVerb+ is a GigaVerb with a 1-band parametric EQ included in the Module for greater tonal flexibility.

Bigverb is a slightly trimmed version of the Gigaverb, offering much of the same flexibility and controls as Gigaverb, but in less memory space. Bigverb allows you to achieve high-quality reverb while including one or two other small Modules in the Algorithm.

Like Bigverb, MFX Reverb is a slimmer and trimmer version of Gigaverb, but MFX Reverb is specifically designed to fit efficiently into Algorithms using multiple effects Modules.

Also available are true stereo reverbs: Stereo Gigaverb and Stereo Bigverb. These Modules allow channel inputs to remain totally discrete, thereby retaining the imaging of stereo input sources. These reverbs also offer stereo mix controls that allow mixing of left- and right-channel early reflections and reverberations.

These controls can be used to blur stereo imaging of input sources, creating a subtle stereo ambience rather than fully discrete reverberation channels. Before covering all the reverb Parameters and their definitions in detail, let's discuss the benefits and theory behind reverberation Algorithms.

Reverberation, or room ambience, occurs when acoustic energy is reflected off room surfaces, materials and objects. Using reverberation in recorded program material gives the listener a sense that the material is being performed in an actual room or hall. It is this similarity to actual acoustic spaces that makes reverberation a useful tool in recorded music.

The TSR-24S uses early reflections in several Modules to get a better emulation of the natural sound of a room. Early reflections are short clusters of direct reflections from the closest room walls. In an average size room, these direct reflections usually occur within the first 30 to 100 milliseconds, depending on the size of the room and the placement of the sound source within the room. Adding these early reflections to the reverberation increases the perceived reverberation time and the apparent size of the reverberant space, but adding more than small amounts tends to make the reverb sound unnatural.

ExaVerb and VeraVerb Parameters and their functions are as follows:

Reverb On / Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.
Reverb Level .....Controls the overall level of the reverberations. Varies from 1 to 100.
Predelay .....Controls the length of time before the reverberations are heard. Ranges in milliseconds from 0 to 100.

Density ..... Similar to DIFFUSION, except that it controls the smoothness of the first portion of the reverberation envelope. For example, if DENSITY is set low and DIFFUSION is set high, the resulting reverberations are heard as discrete taps followed by diffuse room reflections. Conversely, if DENSITY is set high and DIFFUSION is set low, the resulting reverberations are perceived as being smoother overall with a light flutter as they decay. Ranges from 1 to 10.

Filter Type ..... Appears only in ExaVerb. Sets the function of the band-limiting filter as signal enters the Module. Options are LOW PASS, HIGH PASS, and BYPASS.

Filter Frequency ..... Sets the filter rolloff frequency. If FILTER TYPE is set to LOW PASS, frequencies above the setting of this Parameter will be rolled off rapidly. Conversely, if FILTER TYPE is set to HIGH PASS, frequencies below the setting of this Parameter will be rolled off. Ranges from 25 Hz to 20 kHz.

Spread ..... Controls the dispersal of reverberations through the course of the early portions of MID REVERB RT60 and BASS REVERB RT60. Varies from 10 to 400 milliseconds.

Hi-Freq Rolloff ..... This is a low-pass filter that sets the rolloff frequency of the signal entering the Module. This is a band-limiting control, and the frequencies above the setting of this Parameter are rolled off rapidly. Variable from 25Hz to 20 kHz.

Hi-Freq Decay ..... Sets the frequency at which the reverberations begin to lose high-frequency content. In other words, as the reverb decays, high frequencies (frequencies above the setting of HI-FREQ DECAY) become less and less apparent through the course of MID REVERB RT60 and BASS REVERB RT60.

Bass Reverb Freq ..... Sets the crossover frequency that divides the low-frequency reverberations from the midrange reverberations. Reverberation frequencies above the setting of this control are rolled off rapidly. Varies from 25 Hz to 20kHz.

Mid Reverb Freq ..... Sets the crossover frequency that divides the midrange reverberations from the high-frequency reverberations. Reverberation frequencies below the setting of this control are rolled off rapidly. Varies from 25 Hz to 20kHz.

Mid Diffusion ..... Controls how diffuse the midrange reverberations become through the course of MID REVERB RT60. Ranges from 1 to 10.

Bass Diffusion ..... Controls how diffuse the low-frequency reverberations become through the course of BASS REVERB RT60. Ranges from 1 to 10.

Reverb Size ..... Sets the apparent size of the reverberant space. As the setting of REVERB SIZE is increased or decreased, the settings of both MID REVERB RT60 and BASS REVERB RT60 change to correspond with the new room size setting (the settings of MID REVERB RT60 and BASS REVERB RT60 retain the same settings relative to each other when REVERB SIZE is modified). However, changing the setting of either MID REVERB RT60 or BASS REVERB RT60 **does not** affect the setting of REVERB SIZE. Ranges from 1 to 10.

Mid Reverb RT60 ..... Controls the length (RT60) of the midrange and high reverb frequencies **after the input signal has stopped**. Ranges from .01 seconds to 20 seconds, depending on the setting of REVERB SIZE. This Parameter can also be modified using the REVERB SIZE Parameter, but retains its setting relative to BASS REVERB RT60.

Bass Reverb RT60 ..... Controls the RT60 of the low frequency reverberations **after the input signal has stopped**. Ranges from .01 seconds to 20 seconds, depending on the setting of REVERB SIZE. This Parameter can also be modified using the REVERB SIZE Parameter, but retains its setting relative to MID REVERB RT60.

RT60 ..... ExaVerb only. Sets the length of the reverberation decay. Ranges from .01 seconds to 20.00 seconds.

BassEmphasisFreq ..... ExaVerb only. Sets the frequency center for the low-frequency EQ (shelving). Variable from 25 Hz to 20 kHz.

BassEmphasisGain ..... ExaVerb only. Sets the amount of boost or cut at the frequency specified by BASSEMPHASISFREQ. Ranges from -15.0 to +15.0

Mid Reverb Level ..... Sets the overall level of the midrange reverberations. Varies from 0 to 100.

BassReverb Level .....Sets the overall level of the low-frequency reverberations. Varies from 0 to 100.

RV Presence Freq.....Sets the center frequency for the reverb presence control. Varies from 25 Hz to 20 kHz.

RV Presence Q.....Sets the Q of the reverb presence control. For more information on Q, see the equalizer section, pg. 44.

RV Presence Gain.....Controls the amount of gain at the center frequency of the reverb presence control. Ranges from -15 dB to +15 dB.

Hi Emphasis Freq .....ExaVerb only. Sets the frequency center for the high-frequency EQ (shelving). Variable from 25 Hz to 20 kHz.

Hi Emphasis Gain .....ExaVerb only. Sets the amount of boost or cut at the frequency specified by HI EMPHASIS FREQ. Ranges from -15.0 to +15.0

Stereo Blend .....Used for stereo reverb setups, STEREO BLEND controls the amount of reverberation reflections from the left channel of the stereo image to be mixed into the right channel, and vice versa. When set at 0, the stereo image of the reverberation is completely preserved, with no mixing of reverberations from opposite channels. As this Parameter is increased, the stereo image becomes less and less apparent, until, at a setting of 100, the reverberations from both the left and the right can be heard in either channel.

Front Level.....ExaVerb only. Sets the overall level of the reverb at outputs 1 and 2 of the Module. Ranges from 0 to 100.

Back Delay .....ExaVerb only. Controls the amount of delay before reverberations are heard at outputs 3 and 4 of the Module. Variable from 0 to 100 milliseconds.

Back Level.....ExaVerb only. Sets the overall level of the reverb at outputs 3 and 4 of the Module. Ranges from 0 to 100.

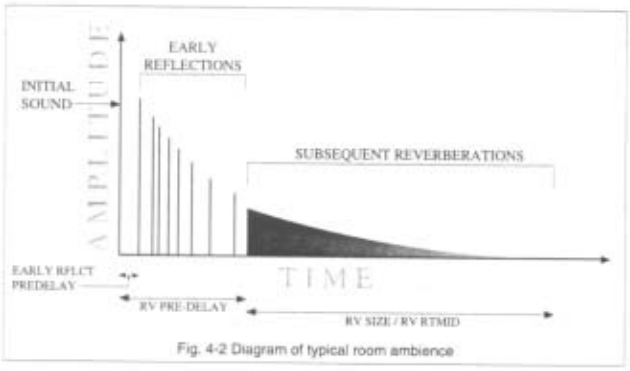


Fig. 4-2 Diagram of typical room ambience

The Gigaverb's SPREAD, SHAPE and RV SIZE controls allow you to modify the build/decay of the early portion of the reverberation envelope and the relative reverberation time of the midrange reverb frequencies. The SHAPE Parameter controls the shape of the early reflection envelope, and ER SPREAD sets the time over which this early reflection shape is achieved. A chart showing all 16 early reflection shapes can be found on pg. 34.

The RV SIZE control is the master control for the apparent room size. The RV RTMID and RV RTBASS Parameters vary in relation to the setting of the RV SIZE. This means that as RV SIZE is modified, the RV RTMID and RV RTBASS Parameters change to correspond to the selected room size. These values are calculated automatically, and the relative settings of RTMID and RTBASS remain the same. The RV SIZE Parameter **does not** vary when RV RTMID or RV RTBASS is modified.

These few controls, in conjunction with the RV XOVER FREQUENCY, RV DIFFUSION, RV HI-FREQ DECAY, RV HI-FREQ ROLLOFF and RV MID and BASS LEVEL controls, give your simulated environment its reflectivity characteristics and can be used to simulate the presence of nearly any type of large-area reflective surface in a reverberant space, such as wood, carpet, glass, metal, etc.

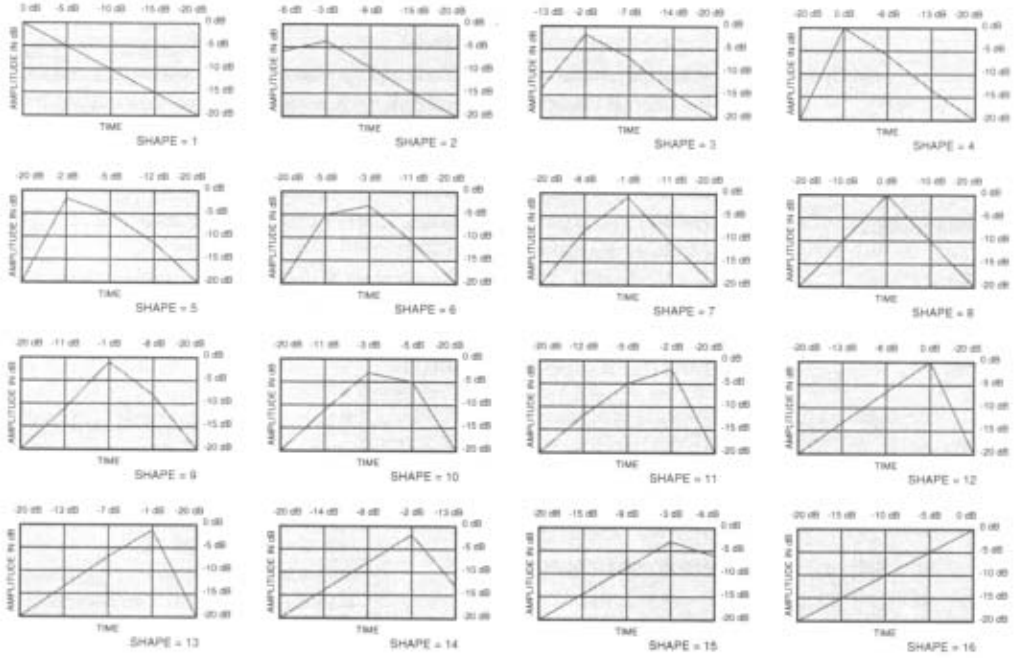
Parameters for GigaVerb, BigVerb, MFXVerb, and stereo reverb Modules are as follows:

Reverb On / Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.

ER Predelay.....Controls the length of time before the early reflections are heard. Ranges in milliseconds from 0 to 100.

ER Spread.....Controls the length of time over which the early reflections occur. Low settings yield a dense, smooth cluster of early reflections while higher settings spread the same number of reflections out over a longer period of time. Ranges from 20 to 600 milliseconds.

ER Shape.....Controls the shape of the early reflection envelope. There are 16 different early reflection envelope shapes. (See chart.) The following diagram shows all the available early reflection envelope shapes. The numbers across the top of each envelope shape graph represent the relative level of the signal at each point in the envelope.



ER Stereo Blend.....Appears only in the Stereo GigaVerb Module. Controls the amount of early reflections from the left side of the stereo image to be mixed into the right channel, and vice versa. When set at 0, the stereo image is completely preserved with no mixing of early reflections from opposite channels. As this Parameter is increased, the stereo image becomes less and less apparent, until, at a setting of 100, the early reflections from both the left and the right can be heard in either channel.

ER Diffusion.....Controls the smoothness of the early reflections. Ranges from 1 to 10.

ER Front Level.....Master level control for early reflections in the left front and right front channels. Ranges from 0 to 100.

ER Back Level.....Controls the amount of early reflections heard in the back speakers of a quad-output setup. Varies from 0 to 100.

RV Predelay.....Controls the amount of time before the first room reverberations are heard. In an actual acoustic space, the amount of reverberation predelay depends largely on the shape and size of the room and the placement of both listener and sound source within the room. Long RV PREDELAY settings place the reverberation behind the program material (in time, not stereo soundfield) rather than in sync with it. Ranges in milliseconds from 0 to 100.

RV Spread ..... Controls the dispersal and density of reverberations through the course of the early portions of RV RTMID and RV RTBASS. Varies in 20 ms increments from 20 to 200 ms.

RV XOver Freq ..... Sets the frequency that the transition from RV RTBASS to RV RTMID occurs at. We recommend that this control be set at least two octaves higher than the frequency you want to boost. For example, if you want to boost a signal at 200 Hz, set the RV XOVER FREQ control to 800 Hz (an octave above 200 Hz is 400 Hz, two octaves above = 800 Hz).

RV Diffusion ..... RV DIFFUSION controls the smoothness of the reverberation. In a real room, reverberation is naturally diffused by the air. However, diffusion can also be affected by temperature, humidity and the presence of absorptive materials in the reverberant space. Ranges from 1 to 10.

RV Hi-Freq Decay ..... Controls the decay length (damping) of the high frequency reverberations. Variable from 25Hz to 20 kHz.

RV Hi-FrqRolloff ..... This is a low-pass filter that sets the rolloff frequency of the reverberations. This is a band-limiting control, and the frequencies above the setting of this Parameter will be rolled off rapidly. Variable from 25Hz to 20 kHz.

RV Size ..... Sets the apparent size of the reverberant space. As the setting of RV SIZE is increased or decreased, the settings of both RV RTMid and RV RTBASS change to correspond with the new room size setting (the settings of RV RTMID and RV RTBASS retain the same relative settings when RV SIZE is modified). However, changing the setting of either RV RTMID or RV RTBASS **does not** affect the setting of RV SIZE. Ranges from 1 to 10.

RV RTMid ..... Controls the length (RT60) of the midrange reverb frequencies **after the input signal has stopped**. Remember that after the reverberations have decayed 15 dB in the presence of continuous program material, they are no longer audible to the listener. Ranges from .01 seconds to 20 seconds, depending on the setting of RV SIZE.

RV RTBass ..... Controls the RT60 of the low frequency reverberations **after the input signal has stopped**. Ranges from .01 seconds to 20 seconds, depending on the setting of RV SIZE.

RV Mid Level ..... Sets the overall level of the midrange reverberations. Varies from 0 to 100.

RV Bass Level ..... Sets the overall level of the low-frequency reverberations. Varies from 0 to 100.

RV Stereo Blend ..... Appears only in stereo reverb Modules. Controls the amount of reverberation reflections from the left side of the stereo image to be mixed into the right channel, and vice versa. When set at 0, the stereo image of the reverberation is completely preserved, with no mixing of reverberations from opposite channels. As this Parameter is increased, the stereo image becomes less and less apparent, until, at a setting of 100, the reverberations from both the left and the right can be heard in either channel.

RV Front Level ..... Controls the overall level of the reverb heard in the front left and right channels (in quad out configurations). This control also acts as the master level for stereo setups.

RV Back Delay ..... Sets the delay time between the front and rear speaker reverberations. Varies from 0 to 100 milliseconds.

RV Back Level ..... Controls the overall level of the rear speakers in a quad output configuration. Ranges from 0 to 100.

Gated Reverbs

Module Name	Module Abbrv.	Description
Gated Reverb	GtRvb	Mono in, stereo out gated reverb

Gated reverbs usually include adjustable thresholds to set the point at which the reverberations will be gated (cut off). RVB DECAY TIME acts in a similar way, except that the length is set in time (milliseconds) instead of level (threshold). In figure 4-3, you can see that reverberations occurring after the RVB DECAY TIME are muted. This causes the reverberations to cut off abruptly.

Gated reverbs are most commonly used on percussion, but there are other ways to employ the unique sound they produce. For instance, using a RAMP UP envelope shape, a reverse gate can be accomplished. Rather than decaying out to be cut off by the gate, a reverse gate builds for a specific amount of time, and is cut off by the gate. Reverse envelopes are similar in sound to playing a record backwards. Figure 4-4 shows how it works.

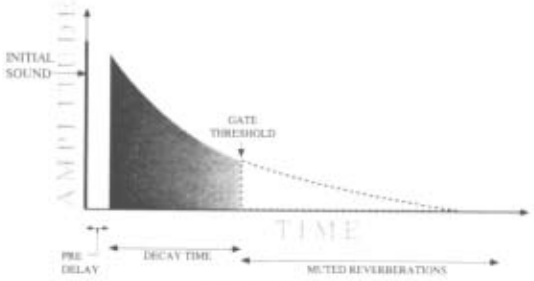


Fig. 4-3. Gated Reverb

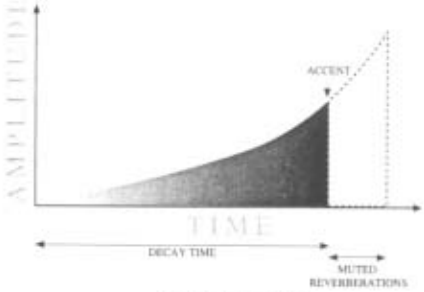


Fig. 4-4. Reverse Gate

The accent point shown in the diagram allows placement of the actual sound, either before or after the gate has cut off the reverberation.

The TSR-24S offers three different envelope shapes in the gated reverb Modules: RAMP DOWN, FLAT, and RAMP UP. RAMP DOWN is a standard gated reverb envelope, with a linear decay to the cutoff point. In most applications, the RAMP DOWN envelope doesn't need an accent point, although it can produce some interesting unnatural sounds. In instances where an accent point is not needed, simply turn down the left and right RVB ACCENT Parameters.

Using a FLAT envelope shape, the reverberation neither decays nor builds, but remains at a constant level for a specified amount of time (determined by the setting of RVB DECAY TIME). This shape is particularly useful for short, percussive sounds.

RAMP UP allows creation of dramatic reverse gate reverb effects, with placement of the accent point permitted within 50 milliseconds before or after the end of RVB DECAY TIME. Gated reverbs can be found in the <REVERB> library, and their Parameters are as follows:

Gated Reverb On/Off .....Turns the Module on or off. Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

Rvb Pre-Delay .....Sets the amount of time before the reverberations are heard. Adjustable from 0 to 100 milliseconds.

Rvb Decay Time .....Controls the amount of time before the gate cuts off the reverberations. Variable from 20 to 1000 milliseconds.

Rvb Envelope.....Sets the shape of the reverberation envelope (RAMP DOWN, FLAT, or RAMP UP).
Rvb Diffusion.....Controls the smoothness of the reverberations. Variable from 1 to 10.
Rvb LPF Frequncy.....Sets the frequency below which reverberations will be heard. Adjustable from 25Hz to 20kHz.
Rvb Accent Delay.....Allows placement (in time) of the actual sound, between 50 milliseconds before and 50 milliseconds after the reverb has been gated.
Rvb Accent Left.....Controls the accent level in the left side of the stereo soundfield. Variable from 0 to 100.
Rvb Accent Right.....Controls the accent level in the right side of the stereo soundfield. Variable from 0 to 100.
Rvb Level Left.....Sets the output level of the reverberations for the left channel. Variable from 0 to 100.
Rvb Level Right.....Sets the output level of the reverberations for the right channel. Variable from 0 to 100.

Delays

Module Name	Module Abbrv.	Description
Mono Delay x.x	Dly	Mono in/out 1-tap digital delay
2Tap Delay x.x	2TDly	Mono input 2-tap digital delay
4Tap Delay x.x	4TDly	Mono input 4-tap digital delay
Stereo Dly x.x	SDly	Stereo input/output 1-tap digital delay
Modulated Delay	MDly	Stereo input/output 1-tap digital delay
StModulated Delay	SMDl	Stereo input/output 1-tap digital delay

All the non-modulated delays in this group have the same basic Parameters for controlling the behavior of the Module. General Parameters include DELAY ON/OFF, DELAY LEVEL, DELAY TIME, DELAY FEEDBACK and DELAY REPEAT HOLD. The only differences between them are in the number of taps available. The multi-tap delays also include independent delay time controls for each tap with a feedback control on the last tap in the series.

The Modulated Delays are a DigiTech exclusive that allow you to modulate the pitch of the delay repeats. They are similar in most respects to the rest of the delay family, but include an LFO modulation section like a chorus Module. The overall effect is that modulation is not heard in the signal until the delays begin repeating.

Each delay Module has a number that immediately follows the name. These numbers represent the amount of delay time in seconds available to each Module. For example, if the Module name shown in the display reads 4TDLY 0.5, you know that the Module has a maximum of .5 seconds (or 500 milliseconds) of delay time available.

The available delay time ranges are 0.5 (500 milliseconds), 1.0 (1000 milliseconds), 2.0 (2000 milliseconds), and 5.0 (5000 milliseconds). Each Delay type appears once in each delay time range (with the exception of SDLY, which does not appear in the 5.0 category). Delay Parameters are as follows:

Delay On/Off.....Turns the delay Module either on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.
Delay Level .....Controls the level of the delay Module. Variable from 0 to 100.

Delay Time (Tap #) .....Controls the delay time of the tap indicated in the display. If no tap number is shown, this Parameter controls the delay time of the Module. Delay Time Parameters can be edited in two different ranges to give the most flexibility and accuracy in the least amount of scrolling time. If you press the Parameter <+> key when the cursor is in the *hundred milliseconds* position (one place to the right of the decimal), you will increase the delay time in increments of 100 milliseconds. Pressing the Parameter <NEXT> key moves the cursor to the *third* position to the right of the decimal point, or *milliseconds* position. Each press of the Parameter <+> button from this position increases the delay time in single millisecond steps. Using this method of ranging allows you to scroll rapidly to large-value delay times without having to wait for the unit to scroll to it in single millisecond steps. Note that as you scroll, a BPM (beats-per-minute) display shows the corresponding value. Using this display, you can set your delays to sync with Program material without the time-consuming trial-and-error method and without knowing the delay value in milliseconds. Variable from 0.000 sec. to 5.000 sec.

Delay Feedback (Tap #)....Controls the amount of feedback, or number of repeats, in the delay line. In multi-tap delays, this Parameter controls the feedback amount of the last tap in the series (see fig. 4-5). Variable from 0 (Off) to 99%.

Delay LFO Speed .....Controls the speed of the modulation sweep. Variable from 0.06 to 16.00 Hz. This Parameter appears only in Modulated Delay Modules.

Delay LFO Depth.....Sets the sweep depth (intensity) of the modulation. Variable from 0.00 to 40.00 milliseconds. This Parameter appears only in Modulated Delay Modules.

Delay LFO Type.....Controls the LFO waveform pattern of the modulation. SINE produces a smooth sine wave-type modulation with even transitions in and out of the turnaround points. TRIANGLE is a linear modulation effect, and ramps the pitch of the wave up and down with no slowing at turnaround points. LOGARITHMIC and EXPONENTIAL waveforms are more dramatic in their effect on the signal, producing a subtle bouncing. This Parameter appears only in Modulated Delay Modules. See fig. 4-7.

Delay Repeat Hold.....This is the infinite repeat Parameter. When turned on, the delay taps will repeat indefinitely until DELAY REPEAT HOLD is disengaged (see fig. 3-12), after which they will continue fading out at the rate set by DELAY FEEDBACK. This Parameter is either ON or OFF.

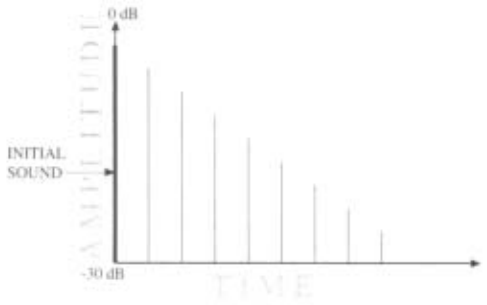


Fig. 4-5 Delay Feedback at 50%

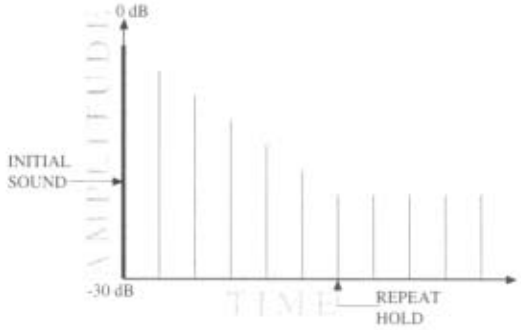


Fig. 4-6 Delay with Repeat Hold

Choruses

Module Name	Module Abbrv.	Description
Mono Chorus	Cho	1-in/1-out chorus
Dual Chorus	DCho	1-input/2-output dual chorus
4 Phase Chorus	4PCho	1-input/4-output 4-phase chorus
Stereo Chorus	SCho	Stereo input/output chorus
Stereo Dual Chorus	SDCho	Stereo input/quad output dual chorus

The TSR-24S offers a diverse selection of choruses, each unique in character and sound. The dual chorus and 4-phase chorus Modules offer exceptionally rich chorusing using multiple voices with different phasing characteristics. The dual chorus Modules use two choruses set 180 degrees out of phase, while the 4-phase chorus Modules include continuously variable independent phase (CHORUS DELAY) Parameters. Chorus Parameters are as follows:

Chorus On/Off.....Turns the Module either on or off. Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

Chorus Level.....Controls the overall level of the chorus. Variable from 0 to 100.

Chorus Predelay.....Controls the amount of delay before the chorused signal is heard. When set short, this Parameter can be useful for widening mono signal imaging. Varies from 0 to 100 milliseconds.

Chorus Delay.....Sets the amount of delay present in the chorus effect. Varies from 0 to 60 milliseconds.

Chorus Speed.....Controls the speed of the chorus sweep. Variable from 0.06 to 20.00 Hz.

Chorus Depth.....This Parameter sets the sweep depth (intensity) of the chorus. Variable from 0.00 to 40.00 milliseconds.

Chorus Waveform.....Controls the LFO waveform pattern of the chorus effect. SINE produces a smooth sine wave-type chorus with even transitions in and out of the turnaround points. TRIANGLE is a linear chorus effect, and ramps the pitch of the wave up and down with no slowing at turnaround points. LOGARITHMIC and EXPONENTIAL waveforms are more dramatic in their effect on the signal, producing a subtle bouncing. See fig. 4-7.

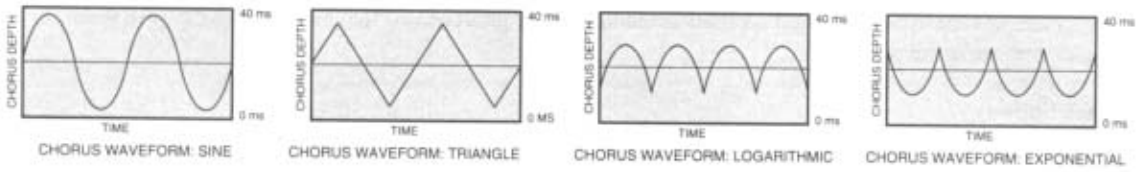


Fig. 4-7 LFO Waveforms

Pitch Shifters

Module Name	Module Abbrv.	Description
Pitch Shift	Pch	1-voice pitch shifter
Dual Pitch	DPch	Dual-voice pitch shifter
St Pitch Shift	SPch	Stereo 1-voice pitch shifter
Mono Detune	Dtn	Mono single detuner
Dual Detune	DDtn	Mono dual detuner
Stereo Detune	SDtn	Stereo single detuner
St Dual Detune	SDDtn	Stereo dual detuner
4 Voice Detune	4VDtn	Quad output 4-voice detuner
Arpeggiator	Arp	Mono single arpeggiator
St Arpeggiator	SArp	Stereo arpeggiator
Whammy	Wham	Real-time multi-function pitch bending
Progrmbl Whammy	PWhm	Real-time pitch bending with flexible programming

The <PITCH> library offers a diverse array of pitch shifter Modules, including dual-voice pitch shifting, detuning, arpeggiation, and Whammy™. Detuning is similar in sound to a chorus, except that its pitch remains constant, rather that modulating back and forth between two points. Detuning is best visualized in terms of two guitar strings tuned to the same approximate pitch; both are tuned to the same note, but each is slightly out of tune with the other. Both notes are constant in pitch, but subtle additions in richness and overtones can be heard.

An arpeggiator is simply a pitch shifter in the feedback loop of a delay. Each time a note is fed back to the input of the pitch shifter, it is once again pitch shifted and sent to the delay, which, in turn, sends part of the signal to the output and the rest back into the pitch shifter to repeat the process. With high feedback settings and short delay times, the sound is reminiscent of an early synthesizer.

Whammy Modules give you access to radical real-time pitch bending capabilities. When you link the WHAMMY CONTROL Parameter to a continuous control device, the fun *really* starts, because you can use things like volume-type pedals and synthesizer modulation or pitch wheels to bend the sound to your will. Parameters are as follows:

Pitch Shifters

Pitch On/Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.

Pitch Level .....Controls the overall level of the pitch shift. Variable from 0 to 100.

Pitch Predelay .....Sets the amount of time, up to 100 ms, before the pitch shifted note is heard. When used with low values, PITCH PREDELAY can be used to widen mono images. Variable from 0 to 100 milliseconds.

Pitch Shift Amount .....Sets the interval between the original note and the pitch shifted note. Variable from -24 to +24 (4 octaves).

Pitch Detune .....Determines the amount of detuning applied to the shifted note. Variable, in cents, from +100 to -100.

Pitch Tracking .....Controls the sound quality/tracking speed of the pitch shifted material. This control should be set in relation to the amount of pitch shifting being performed. That is, as the pitch shift interval increases, PITCH TRACKING should also be increased to optimize sound quality.

Pitch Regenerate .....Controls the amount of pitch shifted material that is fed back to the input of the pitch shifter. High regeneration settings produce interesting unnatural sounds. Varies from -99% to +99%.

Detuners

Detune On/Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

Detune Level .....Sets the level, 0 to 100.

Detune Predelay .....Sets the amount of time, up to 100 ms, before the detuned note is heard.

Detune Amount .....Controls the amount of detuning. Variable, in cents, from -100 to +100.

Arpeggiators

Arpeggiator On/Off .....Turns the Module on or off.

Arpeggiator Level .....Controls the overall level of the arpeggiator. Variable from 0 to 100.

Arpeggio Shift .....Sets the interval between the original note and the shifted note. Variable from -24 to +24 (4 octaves).

Arpeggio Detune .....Determines the amount of detuning applied to the shifted note. Variable, in cents, from -100 to +100.

Arpeggio Pitch Tracking ..Controls the sound quality/tracking speed of the pitch shifted material. This control should be set in relation to the amount of pitch shifting being performed. That is, as the pitch shift interval increases, ARPEGGIO PITCH TRACKING should also be increased to optimize sound quality.

Arpeggio Delay .....This controls the delay and is adjustable from 0 to 1.5 seconds.

Arpeggio Feedback .....Sets the amount of pitch shifted material that is fed back into the input of the arpeggiator. High settings of ARPEGGIO FEEDBACK produce interesting unnatural sounds.

Whammy™

Effect On / Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

Whammy FX Level .....Controls the overall level of the Whammy effect. Varies from 0 to 100. This Parameter appears only in the Programmable Whammy™.

Whammy Dry Level .....Controls the level of the dry (uneffected) sound. Ranges from 0 to 100. This Parameter appears only in the Programmable Whammy™.

Whammy Min Pitch .....Sets the amount of pitch shifting when the controller is at the minimum setting. Varies from -24 to +24 semitones. This Parameter appears only in the Programmable Whammy™.

Whammy Min Dtune .....Sets the amount of detuning when the controller is at the minimum setting. Varies from -100 to +100 cents. This Parameter appears only in the Programmable Whammy™.

Whammy Max Pitch .....Sets the amount of pitch shifting when the controller is at the maximum setting. Varies from -24 to +24 semitones. This Parameter appears only in the Programmable Whammy™.

Whammy Max Dtune .....Sets the amount of detuning when the controller is at the maximum setting. Varies from -100 to +100 cents. This Parameter appears only in the Programmable Whammy™.

Whammy Function .....Selects the function of the Whammy Module. There are 16 functions available in regular Whammy Modules. They are as follows:

Shallow Detune	Deep Detune
1 Octave Above	2 Octaves Above
2nd Below	1 Octave Below
2 Octaves Below	2ndAbv to 3rdAb
min3Abv-maj3Abv	3rdAbv to 4thAb
4thAbv to 5thAb	5thAbv to 6thAb
5thAbv to 7thAb	4thBlw to 3rdBl
5thBlw to 6thBl	OctBlw to OctAb

This Parameter does not appear in the Programmable Whammy™.

Whammy Control.....The WHAMMY CONTROL Parameter reflects the current setting of the continuous control device. This Parameter can be modified manually using the Parameter <+> and <-> keys, the Data wheel, or by using a continuous control device (such as the DigiTech MC²) to perform the Whammy™ function. As this Parameter is modified, the pitch of the original note will change in intervals according to the setting of WHAMMY FUNCTION.

Whammy Tracking .....Controls the sound quality/tracking speed of the pitch shifted material. This control should be set according to the amount of pitch shifting being performed. That is, as the pitch shift interval increases, TRACKING should also be increased to optimize sound quality. Each value setting of this Parameter is optimized for specific ranges of pitch shifting. For instance, if the value displayed reads 6-10, it means that the setting of WHAMMY MIN PITCH or WHAMMY MAX PITCH should be between 6 and 10 semitones from the original note for best sound quality. This Parameter appears only in the Programmable Whammy™.

Samplers

Module Name	Module Abbrv.	Description
Sampler 1.0 Sec	Smpl	1 second mono sampler Module
Sampler 2.5 Sec	Smpl	2.5 second mono sampler
Sampler 5.0 Sec	Smpl	5 second mono sampler
St Sampler 1.0	SSmpl	1 second stereo sampler Module
St Sampler 2.5	SSmpl	2.5 second stereo sampler

The TSR-24S offers several sampler Modules in different time ranges and input/output routings to maximize flexibility and usefulness. All Modules offer 48 kHz sample rates for professional studio-grade samples. Sample recording and playback can be triggered from an external switching device (such as the DigiTech FS300) or via MIDI (through continuous controller linkages). Sample recording can also be triggered on detection of a sound source at the inputs. Parameters of sampler Modules are as follows:

Sampler On/Off.....Turns the Module on or off. Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

Playback Level .....Determines the overall level of the sample when played back. Variable from 0 to 100.

Auto Retrigger .....Has two settings: MANUAL and AUTO. When the Parameter is set to MANUAL, the sample must be triggered either manually or using an audio trigger. When the sample is finished playing, it resets and waits for another manual trigger. When this Parameter is set to AUTO, the sample begins playing. When the sample is finished playing, it is automatically retriggered from the beginning of the sample, and continues retriggering until this Parameter is switched back to MANUAL.

Record Enable .....Sets the mode of operation for the sampler Module. When set to RECORD, the sampler will record a new sample into memory when triggered. When set to PLAYBACK, the sample in memory will be played back when triggered. After you record a sample, this Parameter is reset to PLAYBACK.

Manual Trigger .....This Parameter allows manual playback triggering of the sample in memory. To trigger the sample, press the Parameter <+> key on this screen.

Arm AudioTrigger .....Determines whether audio triggering or manual triggering is active. There are two audio triggering options and one manual triggering option. When set to MANUAL TRIG, samples and sampling are triggered using manual methods (footswitch, front panel, etc.). When set to AUDIO TRG ONCE, the sample is triggered once using an audio source of a set level (determined by the setting of INPUT TRIG LEVEL), then this Parameter is reset to MANUAL. When set to AUDIO RE-TRIG, the sample is retriggered any time a signal over the level setting of INPUT TRIG LEVEL is detected.

Input Trig Level .....Sets the level at which the audio signal will trigger the sample. Variable from 0 to 100.

Direct Level.....Sets the level of the dry (non-effected) sound. Variable from 1 to 100.

Sample Start.....Determines the point at which the sample will begin playing. This Parameter can be used to eliminate unwanted sounds at the beginning of the sample, such as breath noise, empty space (silence), fret noise, amplifier buzz, wrong notes, etc. Each time this Parameter is changed, the sample is retriggered. This allows easy editing of start sample points (try turning the data wheel!). This control can be set at any point in the sample below the setting of SAMPLE END. Like the DELAY TIME Parameter of delay Modules, this Parameter is controlled in two ranges and shows a corresponding BPM (beats-per-minute) value in the display. Refer to the section on controlling the delay time of a delay Module for explanation of the ranges.

Sample Stop .....Determines the point at which the sample stops playing. This Parameter can be used to eliminate unwanted sounds from the end of the sample. It can also be set at any point in the sample above the setting of SAMPLE START. Like the DELAY TIME Parameter of delay Modules, this Parameter is controlled in two ranges and shows a corresponding BPM (beats-per-minute) value in the display. Refer to the section on controlling the delay time of a delay Module for explanation of the ranges.

Equalizers

Module Name	Module Abbrv.	Description
HighPass Filter	HPF	Double-pole high-pass filter
Low Pass Filter	LPF	Double-pole low-pass filter
6Bnd GEQ	GEQ6	Full bandwidth 6-band graphic equalizer
10Bnd GEQ	GEQ10	Full bandwidth 10-band graphic equalizer
15 Band GEQ	GEQ15	Full bandwidth 15-band graphic equalizer
1Bnd ParamtrcEQ	PEQ1	1-band parametric equalizer
3Bnd ParamtrcEQ	PEQ3	3-band parametric equalizer
5Bnd ParamtrcEQ	PEQ5	5-band parametric equalizer with shelving high and low
Bandpass Filter	BPF	Double-pole bandpass filter
Notch Filter	Notch	Double-pole notch filter

The equalizer Modules provided in the TSR-24S offer superb noise performance and allow accurate tonal shaping of many different types of sound sources. There are three different graphic EQs, each optimized for use with specific instruments, while the high-pass, low-pass, bandpass, and notch filters allow precise band limiting of source material. Parametric equalizers are represented in 1-band, 3-band, and 5-band Modules, all with adjustable Q (see discussion of Q on next page). The 5-band parametric has shelving-type high- and low-frequency controls, each with selectable frequency. Also included in the TSR-24S's equalization arsenal are two general purpose EQs (one 10-band and one 15-band). All equalizer Modules offer silent, double-precision tonal shaping.

Adjustable Q equalizers offer the ability to control the bandwidth of the boost/cut ranges. High Q settings yield extremely narrow bandwidth, where boost and cut have minimal effect on frequencies adjacent to the center frequency. Fig. 4-8 shows how low Q settings affect a wider number of frequencies when the selected band is boosted or cut.

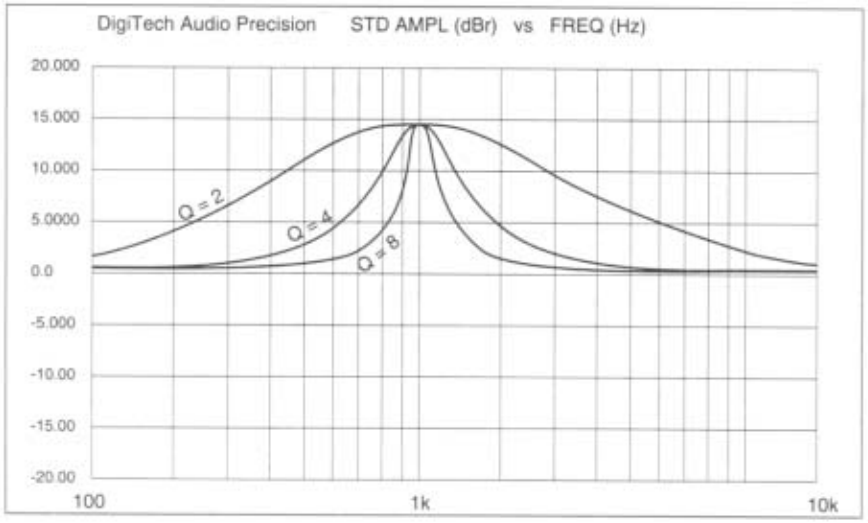


Fig. 4-8 How Q settings affect bandwidth

With a Q setting of 2, you can see that a large number of frequencies are affected by boosting the center frequency. Now take a look at the middle and lower curves in the diagram. The curves with Q setting of 4 and 8 have a much narrower bandwidth.

Flangers

Module Name	Module Abbrv.	Description
Mono Flange	Fla	Mono flange
Dual Flange	DFla	1-input/2-output dual flange
4 Phase Flange	4PFla	1-input/4-output flange w/independent phasing
Stereo Flange	SFla	Stereo input/output flange

The flanger Modules in the TSR-24S are both flexible and powerful, and cover enough sonic territory to fill any demand. Each is unique in character and sound. The dual flange and 4-phase flange Modules offer exceptionally rich flanging using multiple voices with different phasing characteristics. The dual flange Modules use two flangers set 180 degrees out of phase, while the 4-phase flanger Module utilizes a 90-degree phase relationship between taps and controlled by a single Parameter (FLANGE DELAY). Flange Parameters are as follows:

Flange On/Off .....Turns the Module either on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.

Flange Level .....Controls the overall level of the flange. Variable from 0 to 100.

Flange Predelay .....Controls the amount of delay before the flanged signal is heard. When set short, this Parameter can be useful for widening the image of a mono signal. Varies from 0 to 100 milliseconds.

Flange Delay .....Sets the amount of delay present in the flange effect. Varies from 0 to 10 milliseconds.

Flange Speed .....Controls the speed of the flange sweep. Variable from 0.06 to 16.00 Hz.

Flange Depth.....This Parameter sets the sweep depth (intensity) of the flange. Variable from 0.00 to 40.00 milliseconds.

Flange Waveform.....Controls the LFO waveform pattern of the flange effect. SINE produces a smooth sine wave-type flange with even transitions in and out of the turnaround points. TRIANGLE is a linear flange effect, and ramps the pitch of the wave up and down with no slowing at turnaround points. Flangers usually sound best using LOGARITHMIC or EXPONENTIAL waveforms, but don't be afraid to experiment. See fig. 4-9.

Flange Feedback.....This Parameter controls the amount of effect fed back into the signal. Adjustable from -99% to 99%.

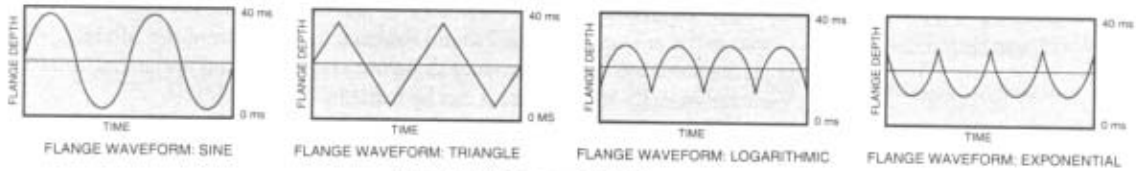


Fig. 4-9 Flanger LFO Shapes

Mod (Modulation Effects)

Module Name	Module Abbrv.	Description
Mono Tremolo	Trm	1-in/1-out tremolo
Stereo Tremolo	STrm	Stereo input/output tremolo
Auto Panner	Pan	1-in/1-out auto panner
Mono Phaser	Pha	Mono in / out phaser
Stereo Phaser	SPha	Stereo in / out phaser
4 Voice Phaser	4PPha	1-in/4-out phaser with independent tap phasing
4Way AutoPanner	4Pan	1-in/4-out auto panner

Tremolo was one of the first real "effects" and appeared mostly on early guitar amplifiers. Because of this, tremolo is sometimes perceived as sounding "old" or "vintage." The TSR-24S, however, breathes new life into this classic effect, providing totally silent volume modulation of sound sources. An auto panner is a modern relative of the tremolo that, instead of modulating the volume of the entire sound, modulates the sound from left to right at a given rate. Both tremolo and auto panner Modules can be found in the <MOD> library. Parameters are as follows:

Tremolos

Tremolo On/Off .....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.
Tremolo Level.....Controls the output level of the tremolo effect.
Tremolo Speed.....Controls the tremolo speed (speed of modulation).
Tremolo Depth .....Adjusts the intensity of the tremolo effect.

Auto Panners

Auto Panner On/Off.....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.
Panner Level .....Controls the output level of the panning effect. Varies from 0 to 100.
Panner Speed .....Controls the panning speed (speed of modulation). Varies from 0.06 Hz to 16.00 Hz.
Panner Depth .....Adjusts the intensity of the panning effect. Varies from 1 to 100.

Phasers

Effect On / Off.....Turns the Module either on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.
Phaser Level .....Controls the overall level of the phaser. Variable from 0 to 100.
Phaser Regeneratn .....Controls the amount of phased sound fed back to the input of the Module. High regeneration settings produce dramatic and interesting unnatural sounds. Varies from -99% to +99%, and can be turned OFF.
Phaser Speed .....Controls the speed of the phase sweep. Variable from 00.00 to 20.00 Hz.
Phaser Depth.....This Parameter sets the sweep depth (intensity) of the phaser. Variable from 0.00 to 40.00 milliseconds.
Phaser Waveform.....Controls the LFO waveform pattern of the phasing effect. SINE produces a smooth sine wave-type phasing with even transitions in and out of the turnaround points. TRINGL is a linear phasing effect, and ramps the pitch of the wave up and down with no slowing at turnaround points. Logarithmic and exponential waveforms offer a more intense sound characteristic unique to the TSR-24S.

More

Module Name	Module Name	Description
Noise Gate	NGt	Mono noise gate
Stereo Noise Gate	SNGt	Stereo noise gate
S-DISC Silencer™	Sinlc	S-DISC Silencer™ Noise Reduction
St S-D Silencer™	SSilnc	Stereo S-DISC Silencer™ Noise Reduction
Mono Ducker	Duc	1-in / 1-out ducker with ducking source input
Stereo Ducker	SDuc	2-in / 2-out ducker with ducking source input
Wah Wah Effect	Wah	1-in / 1-out digital wah wah
Automatic Wah	AWah	1-in / 1-out envelope follower wah
Phase Inverter	Inv	1-in / 1-out phase inverter

The TSR-24S is equipped with DigiTech's proprietary Silencer™ Noise Reduction. The Silencer™ Modules offer seamless, professional-quality noise reduction that can be incorporated into your custom Algorithms (most of the factory Algorithms are also equipped with the Silencer™ Noise Reduction or the Silencer™ Noise Gate).

Also included are Silencer™ noise gate Modules that are flexible enough for use in any application and include special controls that allow independent on-threshold and off-threshold settings. The Silencer™ Noise Gates are simply an expanded version of the Noise Reduction Modules. The range of controls found in these Modules permit gate triggering from a source other than the input signal (controlled by DETECTOR SRC). Silencers™ and Silencer™ Noise Gates can be found in the <MORE> library.

Noise Gates

NGt On/Off .....Turns the Module on or off. Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

NGt Detector Src .....Selects the input(s) that the gate will be keyed from. If keying from a source other than the audio signal, use the left (mono) input as the input for the program material and the right input as the detector input. Using this setup, this control should be set to RIGHT, so that the gate looks for its trigger from the right input. When set to LEFT AND RIGHT, the average level at both inputs must be above the setting of NGT THRESHOLD in order for the gate to open. Similarly, the average level of both inputs must be below the HYSTERESIS setting for the amount of time determined by the setting of NGT HOLD TIME in order for the gate to close.

NGt Threshold .....Sets the level at which the gate will open. As this Parameter is modified, the off-threshold setting changes (according to the setting of NGT HYSTERESIS) to maintain the same relative distance in dB between the on-threshold and the off-threshold. This requires the user to set only one Parameter to control both thresholds. Ranges from -3 dB to -100 dB.

NGt Hysteresis.....Sets the distance (in dB) between NGT THRESHOLD and the off-threshold. For example, if NGT THRESHOLD is set at -40 dB and NGT HYSTERESIS is set at 8 dB, the off-threshold would be 8 dB below the setting of NGT THRESHOLD, or -48 dB. Ranges from 0 to 12 dB.

NGt Hold Time .....Controls the amount of time the signal must remain below the off-threshold before NGT RELEASE TIME begins. This control should be set long enough to prevent false triggering during long decay times.

NGt Attack Time .....Controls the how fast the gate opens after detecting a signal above NGT THRESHOLD. Large numbers yield slower attack times, while small numbers give a fast attack. Varies from 0 to 2000 milliseconds (2 seconds).

NGt Release Time .....Controls how fast the gate closes after the signal has fallen below NGT HYSTERESIS for the amount of time set by NGT HOLD TIME. Large numbers yield slow release times, while small numbers give a fast release. Varies from 0 to 2000 milliseconds (2 seconds).

NGt Attenuation .....Sets the amount of attenuation (signal reduction) when the gate is closed. Varies from 100 dB (below the level of the ungated noise floor) to 0 dB (no attenuation).

NGt Delay Time .....Allows placement of a slight delay on the source signal after the gate is triggered. This Parameter allows source material with a very fast attack time to be heard in its entirety without the lag in gate response that is common to inferior noise gates. Variable from 0 to 10 milliseconds.

Silencers™

Silencer On/Off.....The Silencer™ is unique because it is equipped with a true bypass. When the Silencer™ is bypassed, the signal is passed around the Module, effectively removing it from the signal chain. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, turn the Module on.

SNR Detector Src .....Selects the input source(s) that the Silencer™ will be triggered from. If triggering from a source other than the audio signal, use the left (mono) input as the input for the program material and the right input as the detector input. Using this setup, this control should be set to RIGHT, so that the gate looks for its trigger from the right input. When set to LEFT AND RIGHT, the average level at both inputs must be above the setting of SNR THRESHOLD to trigger the Silencer™.

SNR Threshold .....Sets the level at which the Silencer™ will disengage. Ranges from -3 dB to -100 dB.

SNR Release Time .....Controls how fast the Silencer™ activates after the signal has fallen below SNR THRESHOLD. Large numbers yield slow release times, while small numbers give a fast release. Varies from 0 to 2000 milliseconds (2 seconds).

Duckers

Effect On / Off.....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.

Ducker Threshold .....Sets the minimum input level required to trigger the ducker (it is perhaps easier to think of this Parameter as the ducker sensitivity). Higher settings of DUCKER THRESHOLD require higher input levels to trigger the ducker. Lower settings make the ducking effect easier to trigger. Ranges in 1 dB step from -100 to 0 dB.

Ducker Hold Time .....Controls the amount of time before the ducker disengages **after the input signal has stopped**. Varies from 0.000 to 5.000 seconds.

Ducker Attenuatn .....Adjusts the amount of level attenuation applied to the ducked effects when the ducker is engaged (ducker is engaged when the input level exceeds the setting of DUCKER THRESHOLD). Adjustable from -100 dB to 0 dB.

Dckr Attack Rate .....Sets the amount of time over which the ducker will reach full attenuation. Adjustable in milliseconds from 0.00 to 14.00 seconds.

Dckr ReleaseRate .....Sets the amount of time over which the ducker will disengage. Adjustable in milliseconds from 0.00 to 14.00 seconds.

Wahs

Effect On / Off.....Turns the Module on or off. When Modules are turned off, their Parameters will not be displayed. To see the Parameters, you must turn the Module on.

Wah Level.....Controls the overall level of the wah effect. Varies from 0 to 100.

AWah Sensitivity.....Adjusts the sensitivity of the detection for the automatic wah. High AWAH SENSITIVITY settings cause the wah filter to open wider. Low settings limit the wah filter range. Varies from 0 to 100. This Parameter appears only in the automatic wah Module.

Wah Pedal Positn.....The WAH PEDAL POSITN Parameter reflects the current setting of the continuous control device used to control the wah effect. This Parameter can be modified manually using the Data wheel or by using a continuous control device (such as the DigiTech MC²) to perform the wah function. As the Parameter is modified (either manually or via external controller), the tone of the original note will change, exactly like using a standalone wah pedal.

Phase Inverter

Phase Inverter.....Flips the signal phase 180 degrees. Settings are either IN PHASE or OUT OF PHASE.

Tuning Reference

Reference Level.....Controls the output level of the tuning reference tone. Variable from 0 to 100.

Reference Tone.....Selects the reference tone. This Parameter has settings for standard guitar tuning, standard guitar tuning harmonics (12th fret), E flat guitar tuning tones and 12th fret harmonics, 437-443 Hz tones, and a 1kHz reference tone.

Mixers (mono)

Module Abbrv.	Description
2x1	2-in / 1-out mixer
3x1	3-in / 1-out mixer
4x1	4-in / 1-out mixer
5x1	5-in / 1-out mixer
6x1	6-in / 1-out mixer
7x1	7-in / 1-out mixer
8x1	8-in / 1-out mixer
10x1	10-in / 1-out mixer

Mixers (stereo)

Module Abbrv.	Description
2x2	2-in / 2-out mixer
3x2	3-in / 2-out mixer
4x2	4-in / 2-out mixer
5x2	5 in / 2-out mixer
6x2	6-in / 2-out mixer
7x2	7-in / 2-out mixer
8x2	8-in / 2-out mixer
10x2	10-in / 2-out mixer
12x2	12-in / 2-out mixer
14x2	14in / 2-out mixer
16x2	16-in / 2-out mixer

Mixers (3-out)

Module Abbrv.	Description
2x3	2-in / 3-out mixer
3x3	3-in / 3-out mixer
4x3	4-in / 3-out mixer
5x3	5 in / 3-out mixer
6x3	6-in / 3-out mixer
7x3	7-in / 3-out mixer

When you Link your custom Algorithms together, the TSR-24S will allow a single output to be routed to any number of inputs. The reverse, however, is not true. If you want more than one output routed to a single input, you must use a mixer, just like you would if you were using discrete effects devices. The TSR-24S provides a wide range of mixer Modules to accommodate virtually any routing application. Each mixer channel is equipped with an input level and an output level (except 3-out mixers) to give maximum control over levels coming and going to and from different Modules. Mixer Modules are available in 1-out, 2-out, and 3-out configurations. 2-out configurations include pan controls on the inputs, and 3-out mixers have a stereo output pair (outputs 2 and 3) plus a mono output (output 1) that carries a summed version of the signal at outputs 2 and 3.

Why Do You Need Mixers?

The role of mixers in effects chains is probably the most misunderstood and least appreciated. They quietly go about their job without hype or fanfare, and although you may not know it, most multi-effects chains, from the most sophisticated rack units to the simplest stomp boxes, depend on mixers for proper signal handling.

Choruses, delays, reverbs, phasers, flangers, and pitch shifters all rely on a combination of dry signal and effects signal to produce their characteristic sounds. A good example of this is a chorus; a chorused signal by itself (without a dry signal mixed in) sounds like it's slowly moving in and out of tune (a dry signal is, of course, just a plain signal). Only when you combine the modulating signal with the dry signal do you get the dynamic detuning sound you know as a chorus.

Even simple chorus pedals use a 2-input, 1-output mixer just before the output jack to combine the wet and dry signals. The TSR-24S, on the other hand, separates the effects from the mixers to give you maximum flexibility and control over signal flow.

There are other reasons why you might want to use mixers, especially in multi-effects setups. Fig. 4-10 shows a basic multi-effect Algorithm you can easily set up in the TSR-24S. As you can see, the signal passes straight through all the effects to the outputs with no dry paths except the Master Mix control (set at 50:50). Without mixers in place to carry the dry path around each Module, you would hear the dry signal immediately at the outputs without effects (because of the Master Mix path). One second later, after the delay has run its course, you would hear delay repeats with chorus and reverb.

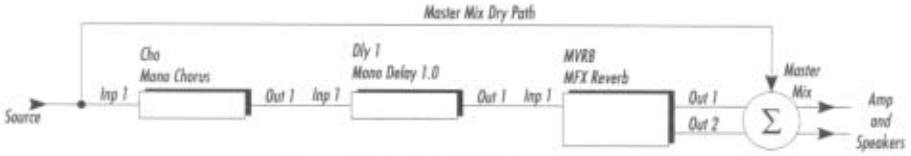


Fig. 4-10 Algorithm with no dry paths

Although perfectly acceptable, this is typically not how you want your effects to behave. Logic dictates that you should hear sound at the outputs with chorus, delay, and reverb *as you play*. Thus the need for mixers.

Fig. 4-11 shows the same Algorithm, except that instead of running the Modules in straight series as in fig. 4-10, mixers are inserted to carry signal around each individual Module and into the next.

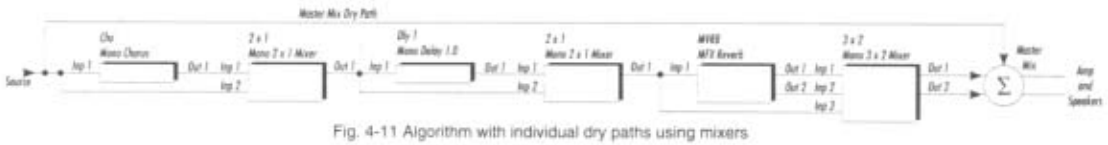


Fig. 4-11 Algorithm with individual dry paths using mixers

When you use mixers in the Algorithm, the input of the delay gets a combined version of the chorused signal and the dry signal. Likewise, the input of the reverb gets a combination of the chorused, delayed, and dry signals, while the Master mix gets a combination of chorus, delay, reverb, and dry, giving you the complete sound at the outputs the way you would expect.

> **NOTE:** The easiest way to control individual effect levels in multi-effects configurations is to run the Master Mix control at ALL WET, mixer levels at 100 and adjust individual effect levels at the Modules themselves (e.g. CHORUS LEVEL, DELAY LEVEL).

What's the point of the Master Mix control? The Master Mix control works best for single effect Algorithms, like Factory Algorithm #1 (GigaVerb 1->4). However, if you find that the overall effect levels are too high in multi-effect setups, you can use the Master Mix control to scale back all the effects at the same time.

Section 5 - The Utility Menu

The Utility section of the TSR-24S contains several functions, including display contrast, the footswitch setup menu and the factory program restore menu. These menus are reached by pressing the <UTILITY> button. Press the <UTILITY> button. The display reads:

```
1Contrast 2Foot
3Re-Init  4Tuner→
```

This is the main Utility options menu. From this selection screen, you can choose the option to edit using the Access keys. Notice that each option has an inverse (white on black) number to the side. These numbers indicate the Access button that you should press to reach each option or submenu.

Adjusting the LCD Contrast

The LCD CONTRAST adjustment control adjusts the angle at which the display can be read most clearly. To change the LCD contrast, do the following:

- After entering Utility mode, press Access key <1>. The display reads:

```
 LCD Contrast
1 6          4Exit
```

  The number indicates the current setting of the LCD contrast.

- Adjust the contrast using the Parameter <+> and <-> keys until the display is easily readable.

- Press Access key <4> to exit and return to the main Utility options menu.

Programming the Footswitch

The TSR-24S's footswitch jack is equipped with automatic polarity sensing and is designed to be used with the optional DigiTech FS-300 footswitch. The FS-300 uses a three-conductor cable for its three switches, each of which can be assigned a separate function in the Footswitch Setup menu found under Utility. Momentary footswitches from other manufacturers (1-, 2-, or 3-switch models) will also work with the TSR-24S's footswitch jack.

The polarization of the footswitch occurs on power up, so it is important to plug in the footswitch before powering up the TSR-24S. If the switch seems to be functioning in reverse (e.g. assigned functions occur on releasing the switch instead of on pressing the switch), leave the footswitch plugged into the back of the TSR-24S and turn the unit off and on again.

The procedure for assigning functions to switches is as follows:

- After entering Utility mode, press Access key <2>. The display reads:

```
1Assign FS
2Edit Prg List
```

- Press Access key <1>. The display reads:

```
Push footswitch
to be programmed
```

- Press the switch you want to assign a function to. For example, press switch C. The display reads:

```
SwitchC Function
Bypass
```

- Select the function you want the switch to perform using the Parameter <+> and <-> keys or the Data wheel and press Access key <4>. The choices are NOT USED, BYPASS, PROGRAM UP, PROGRAM DOWN, PROGRAM LIST UP, PROGRAM LIST DOWN, SAMPLE TRIGGER/REPEAT HOLD, TUNER and TOGGLE CC. Repeat the procedure for devices with more than one switch (such as the DigiTech FS-300).

- When you're finished, press Access key <4> to return to the main Utility options menu.

Program Lists

It is also possible to set up a Program List in the footswitch setup menu . A Program List allows you to set up a specific sequence of Program changes that you can step through one by one using a single footswitch. The Programs you select for your sequence can be in any order. To set up a Program List, do the following:

- After entering Utility mode, press Access key <2>. The display reads:

```
1Assign FS
2Edit Prg List
```

- Press Access key <2>. The display reads:

```
Program Sequence
←Step 1 =Prg 1
```

Note that a cursor appears under the 1 in STEP.

- Using the Program <+> and <-> keys or the Data wheel, select the step number you want to edit. The display looks something like this:

```
Program Sequence
←Step 12=Prg 12
```

- Press <NEXT>. The cursor moves to the PRG side of the display.

- Using the Program <+> and <-> keys or the Data wheel, select the Program number you want the selected step to recall. The display looks something like this:

```
Program Sequence
←Step 12=Prg 14
```

- Move the cursor back and continue these steps until you have given all the desired Programs a Step number (there are 32 steps available). At the end of the sequence (the Step that follows the last Step in your sequence), set the PRG number to END.

NOTE: If all 32 steps are used by Programs, an automatic end is inserted at the end of the sequence.

- Press Access key <4> to return to the main Utility setup menu.

Each time the switch is pressed, the next Program in the Program List is recalled. When you reach the end of the Program List, press the switch again to restart the sequence.

Toggle CC

Footswitches can also be assigned to toggle a specified CC number from 0 to 127 and vice versa. When you link that CC number to a Module On/Off (see pg. 61), you can use the footswitch to turn effects on and off. The procedure is as follows:

- After entering Utility mode, press Access key <2>. The display reads:

```
1Assign FS
2Edit Prg List
```

- Press Access key <1>. The display reads:

```
Push footswitch
to be programmed
```

- Press the switch you want to assign a function to. For example, press switch C. The display reads:

```
SwitchC Function
Bypass
```

- Using the Parameter <+> and <-> keys or the Data wheel, select TOGGLE CC. Note that an arrow appears to the right.

- Press <NEXT>. The display reads:

```
Switch C
← CC =   0
```

- Using the Parameter <+> and <-> keys or the Data wheel, select the CC number you want to toggle with the switch.

- Press Access key <4> twice to return to the main Utility setup menu.

You can use the MIDI Setup Menu to set Parameters to respond to the CC number you just set. Each time you press the switch, the assigned Parameter will toggle between its minimum and maximum settings. This is a convenient way to turn effects on and off with the footswitch. Also, if more that one Parameter in the Program is set up to respond to the CC, it will respond as to footswitch control as well.

Tuner Access

The TSR-24s has a built-in tuner that offers fast, accurate tuning for instruments. To access the TSR-24S tuner, do the following:

- After entering Utility mode, press Access key <4>. The display reads:

```
Tuner A = 440
--  --  --  --
```

- Begin tuning your instrument. As you tune, the note name is shown on the top line of the display, while vertical bars appear on the second line of the display and begin strobing. If the note is sharp, the bars will strobe from left to right. If the note is flat, they'll strobe from right to left. When the note is in tune, the strobing bars will stop moving and asterisks will appear around the note name on the top line of the display.

- To exit the tuner, press <UTILITY>.

Changing the Tuning Reference

You can easily change the TSR-24S's tuning reference by turning the Data wheel in tuner mode. The top line of the display will show the current setting. The default factory setting is: A = 440 Hz. The tuning reference control ranges from 427 Hz to 453 Hz, which is the equivalent of ±50 cents (1/2 semitone) in either direction from 440 Hz.

When you scroll down from 427 Hz, you will also find alternate tunings. Alternate tunings are A_b, G, and $G_\sharp$.

When you use any of the alternate tunings as your reference, tune your instrument so that the display shows normal tuning (E, A, D, G, B, E for guitars) and the TSR-24S will do the rest (the display shows normal tuning, but you'll actually be tuning to your selected reference key).

Restoring Factory Programs

This option allows you to restore the contents of the TSR-24S's memory to the original factory condition.

> **WARNING:** Performing this function will destroy all user-programmed data, **including Programs and Algorithms** and all such data will be lost forever!

To restore the factory Programs, do the following:

- Press <UTILITY> to enter the Utility mode.

- Press Access button <1>. The display reads:

```
Restore Factory
Programs?1Yes2No
```

- Press Access key <1>. The display briefly reads:

```
This will erase
User Programs
```

followed by:

```
Are You Sure?
2Yes  4No
```

- To reset the TSR-24S, press Access button <2>. To abort the command, press Access button <4>. The screen briefly reads:

```
Resetting...
Please wait   /
```

followed by:

```
Reset Global CC?
1Yes  4No
```

- To finish the reset and restore all global CC's, press Access key <1>. To abort the operation, press Access key <4>.

Sales Banner

This determines if the TSR-24S will show the sales banner when first powered up. This function can be turned on or off. If it is turned on when you power up, press any key on the front panel to exit. The procedure for turning the sales banner on or off is as follows:

- After entering Utility mode, press <NEXT> once. The display reads:

```
  Sales Banner
←     Off     →
```

- Use the Parameter <+> and <-> keys or Data wheel to turn the sales banner on or off.

- Press Access key <4> to exit.

When you have finished making changes to the Utility menus, press the <UTILITY> button again to exit back to the mode you were in when <UTILITY> was pressed the first time.

Seamless Program Changes (PPC-200 users only)

With a PPC-200 installed, a third page is added to the Utility menu; it's called the Seamless Program Change menu, and it allows you to determine the behavior of each Program when seamless Program changing occurs.

You also have two basic Algorithm types at your disposal instead of one: single S-DISC Algorithms and dual S-DISC Algorithms. Single S-DISC Algorithms let you take advantage of seamless changing, while dual S-DISC Algorithms give you lots of room for complex effects chains.

The Seamless Program Change menu consists of two Parameters: HOLD and RAMP. These Parameters behave exactly like the sustain-release portion of an ADSR (attack-decay-sustain-release) envelope generator (such as those found in keyboards). HOLD determines how long the currently selected Program holds after a Program change is received, while RAMP controls the length of the Program's decay after HOLD has elapsed.

Fig. 5-1 shows exactly what happens during the course of a seamless Program change. The example settings are: HOLD = 1.4 seconds; RAMP = 2.6 seconds.

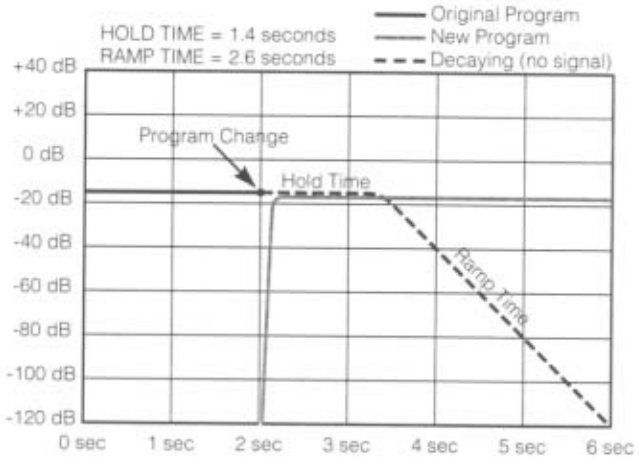


Fig 5-1 How seamless Program changes work

From 0 seconds to 2 seconds, the currently selected Program runs normally using S-DISC 1. At 2 seconds, a Program change message is received, initiating HOLD for the original Program and ramping the S-DISC 1 inputs to zero. Simultaneously, the new Program is loaded into S-DISC 2 and begins running. At 3.4 seconds (1.4 seconds from the Program change), RAMP is initiated, which smoothly ramps the original Program level down to inaudibility over the course of 2.6 seconds.

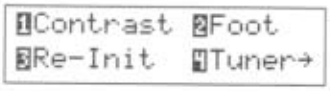
It is significant to note that between the 2 second and 6 second marks, *BOTH PROGRAMS ARE RUNNING AT THE SAME TIME*. No other device currently available from other manufacturers has this ability.

From the factory, each Program has different HOLD and RAMP settings specific to each Program. They are set up to follow the natural decay of the Program as closely as possible.

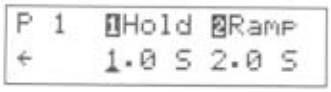
> **NOTE:** Be sure to set up your own Programs this way, as unnecessarily long HOLDs and RAMPs reduce the speed and efficiency of Program changes.

The Seamless Program Change menu can be reached using the following procedure:

- From Performance mode, use the Program <UP> or <DOWN> keys to select the Program you want to change.
- Press <UTILITY> once. The display reads:



- Press <NEXT> twice. The display looks something like this:



Note that a cursor appears under the 1 in HOLD.

This is the seamless Program change setup menu. This menu is Program specific; each Program can be set up to behave differently using this setup screen.

> **IMPORTANT:** The seamless Program change setup menu only shows up WHEN THE CURRENTLY LOADED PROGRAM USES A SINGLE S-DISC ALGORITHM. If this menu does not appear using the procedure described above, check to make sure that the Program uses a single S-DISC Algorithm.

- Using the Data wheel, change HOLD to the desired value.
- Press Function key 2 once. The cursor moves to RAMP.
- Use the Data wheel to select the desired value.
- When you're finished, press <UTILITY> to exit to Performance mode.

The maximum available RAMP time is 10 seconds. HOLD time also has a maximum setting of 10 seconds, but also includes an INFINite option that holds the previous Program indefinitely until the next Program change.

> **IMPORTANT:** The INFIN option is <u>not</u> an infinite repeat for delays or reverbs. Infinitely repeating effects must be set up in the Parameter menu for each Program. The INFIN option allows the infinitely repeating effect to continue without ramping down after a Program change.

Section 6 - The MIDI Menu

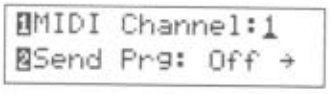
The MIDI menu is the control center for TSR-24S's interaction with other MIDI devices. The MIDI menu contains several important functions, including the TSR-24S MIDI channel, MIDI input *and* output mapping, continuous controller linkages, and MIDI data dumping. To access the MIDI Setup Menu, press the <MIDI> button.

MIDI Channel

The TSR-24S MIDI Channel Parameter allows you to select the MIDI channel the TSR-24S will receive MIDI data on. This can be set to channels 1 through 16, ALL CHANNELS, or DISABLED. If this Parameter is disabled, the TSR-24S will not recognize incoming MIDI data.

To set the MIDI channel Parameter, do the following:

- From Performance mode, press <MIDI>. The display reads:



  Note that a cursor appears under the current MIDI channel setting.

- Use the Parameter <+> and <-> buttons to select the channel you want the TSR-24S to receive MIDI data on.

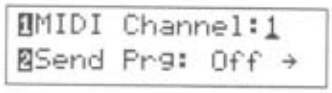
- Press <MIDI> to return to Performance mode.

Send Prg

SEND PRG determines whether or not corresponding Program Changes will be sent out the TSR-24S MIDI port as you scroll through the Programs. This Parameter is either ON or OFF.

To change the current setting, do the following:

- After entering the MIDI menu, press Access key 2. The display reads:



  Note that a cursor appears under OFF.

- Use the Parameter <+> and <-> keys or the Data wheel to change the current setting.

- Press Access button <4> to return to Performance mode.

Prg Send Map (Device Mapping)

PRG SEND MAP allows the TSR-24S to act as a MIDI multiplexer for up to four other devices. Here's how it works: when the TSR-24S receives a Program Change message via MIDI, each device you specify can receive independent Program Change messages on an individual MIDI channel. This feature allows you to receive Program Change messages on one MIDI channel and sent them out separately to other devices on other MIDI channels. To set up external devices, do the following:

- After entering the MIDI setup menu, press <NEXT> once. The display reads:

```
 1Prg Send Map
←2Prg Rcv Map  →
```

- Press Access Key <1>. The display reads:

```
1Device 1
2MIDI Ch 1     →
```

- Use the Parameter <+> and <-> buttons or the Data wheel to select the device number (1-4) you want to edit.

- Press the <NAME> button and give the device a custom name. Naming procedures are found on pg. 18. When you're finished, press <NAME> again and you will be returned to the place you left off.

- Press Access key <2>. The display might look something like this:

```
1DHP-33
2MIDI Ch 1     →
```

- Press Access key <2>. The cursor moves under the MIDI channel number on the bottom line.

- Use the Parameter <+> and <-> keys to select the device's MIDI channel that the TSR-24S will send on (if this Parameter is set to DISABLED, the TSR-24S will not send out any Program Change messages for that device).

- Press the Parameter <NEXT> button. The display reads:

```
 1DHP-33 Send
←2Prg:1  3As:1
```

This screen tells you that when the TSR-24S receives Program Change number 1, Device 1 (named DHP-33) will be sent Program change number 1 on its designated MIDI channel (typically, the device number you choose on this screen will be the same as the device number on the MIDI channel screen).

- Choose the device number you want to map with the Parameter <+> and <-> keys or the Data wheel .

- Press Access key <2>. The cursor appears under PRG: 1.

- Use the Parameter <+> and <-> buttons or the Data wheel to select the TSR-24S Program number (1-256) that will send the mapped Program Change to the external device.

- Press Access key <3>. The cursor appears under AS: 1. This Parameter determines the Program Change number that the external device will receive when the appropriate Program Change number is received on the TSR-24S. If this Parameter is set to DISABLED, nothing will be sent to the external device when the PRG assigned to that device is sent.

- Using the Parameter <+> and <-> buttons, select the Program Change number that will be sent (1-128, DISABLED).

- Continue with these steps until the Programs are mapped as desired.

- Press Access key <4> to return to the main MIDI menu or <UTILITY> to return to Performance mode.

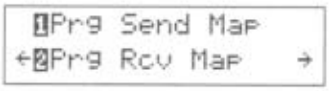
You can map up to four devices or incoming Program Change messages as you like. These are stored in memory automatically and are always active until you change them or until a factory reset is performed.

Prg Receive Map

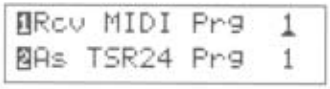
The PRG RECEIVE MAP function allows you to map incoming Program Changes that are within MIDI range to any Program out of MIDI Program Change number range on the TSR-24S. For example, suppose you want to access Program #146 using a MIDI Program Change. Since MIDI only supports Program Change numbers 1 through 128, Program Change number 146 would normally be impossible for the TSR-24S to recognize. However, with the TSR-24S's flexible MIDI input mapping, you can assign a Program Change number that MIDI *will* recognize to be received as Program #146 on the TSR-24S.

To illustrate, let's assign MIDI Program Change number 26 to change the TSR-24S to Program #131.

- After entering the MIDI setup menu, press <NEXT> once. The display reads



- Press Access key <2>. The display reads:



  This display means that MIDI Program Change number 1 is currently set to activate Program number 1 on the TSR-24S.

- Use the Parameter <+> and <-> keys or the Data wheel to set RCV MIDI PRG to 26. Note that as you change this number, the TSR24 PRG number changes with it.

- Press Access key <2>. The cursor appears under TSR24 PRG 26.

- Using the <+> Parameter button or the Data wheel, change the number to 131.

- Press Access button <4> to exit back to the main MIDI setup menu.

Now, when the TSR-24S receives Program Change number 26 via MIDI, Program 131 is recalled. Any number of Program Changes (up to the MIDI maximum of 128) can be mapped to recall any TSR-24S Program.

Linking Continuous Controllers (CC Assignments)

Creating MIDI continuous controller links on the TSR-24S has been specially designed to be extremely fast and simple. Up to 10 Local CC's and 20 Global CC's can be linked to any Parameter in the TSR-24S. The procedure is essentially the same for assigning both local and global CC's.

Local CC's are active only when the Program they are linked to is active. Global CC's are always active. Let's link Local CC #1 to a Parameter item.

To link a Parameter to local MIDI continuous controller #1, do the following:

- From Performance mode, scroll to the Parameter you want to link to a MIDI continuous controller.
- Press and hold the <MIDI> key until the display reads ASSIGNING CC, and then release. The display reads:

```
1LocalCC Link:1
2Assign
```

- Press Access key <2>. The display looks something like this:

```
Chorus Level
No Link          →
```

- Using the Data wheel, choose the CC number you want the Parameter to be linked to. Options are 0-127, CHPRESS (channel pressure), or NO LINK.
- Press <NEXT>. The display reads:

```
Minimum CC Value
←  0             →
```

- Use the Parameter <+> and <-> keys or the Data wheel to select the value you want when the CC pedal is in the minimum position.
- Press <NEXT>. The display reads:

```
Maximum CC Value
←100▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮▮
```

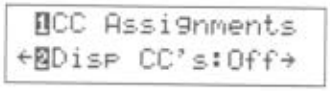
  This screen shows the value of the Parameter when the CC pedal is in the maximum position.

- Press the <MIDI> key to exit to Performance mode. The display shows the Parameter you left off with (Chorus Delay in our example). Note that a small $\mathfrak{C}$ appears next to the Parameter name. This symbol tells you that the Parameter is linked to a continuous controller.

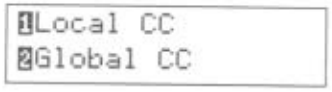
You have successfully linked local CC #1 to control a Parameter. When you move your CC pedal, the TSR-24S sweeps smoothly between the two values you selected. To retain the changes, be sure to store your Program.

The procedure for linking global CC's is similar, except that global CC's cannot be range limited. To assign a global CC, do the following:

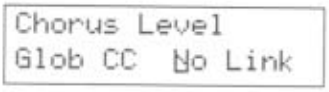
- From Performance mode, scroll to the Parameter you want to link to a global CC and press the <MIDI> button.
- Press <NEXT> twice. The display reads:



- Press Access key <1>. The display reads:



- Press Access key <2>. The display looks something like this:



- Use the Data wheel of the Parameter <+> and <-> keys to select the desired CC number.

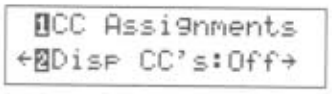
NOTE: In order for the TSR-24S to respond to incoming CCs, the TSR-24S MIDI CHANNEL setting must match the channel designation of the incoming messages. TSR-24S MIDI CHANNEL can be set to any of the 16 MIDI channels, or ALL CHANNELS.

Display CC

This option allows you to display the CC changes as you make them. This is a useful visual cue when troubleshooting, but because it slows down the processing speed, it is not recommended for "live" use.

To display CC's, do the following:

- After entering the MIDI setup menu, press <NEXT> twice. The display reads:



- Press Access key <2> to turn DISPLAY CC'S on.

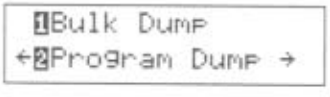
- Press <MIDI> to return to Performance mode.

Bulk Dump

This option allows you to dump a copy of the entire contents of the TSR-24S memory out the MIDI port. This is particularly useful for backing up the memory of the TSR-24S, or for copying all the Programs from one TSR-24S to another. The procedure is as follows:

- Connect the MIDI Out of the TSR-24S to the MIDI In of another TSR-24S, computer, or external System Exclusive recording device.

- After entering the MIDI setup menu, press <NEXT> three times. The display reads:



- Press Access key <1> to begin the bulk dump. The display reads:

```
* Dumping MIDI *
25056 Bytes
```

When the dump is finished, you are returned to the MIDI setup menu.

Program Dump

This option allows you to dump an individual Program from the TSR-24S out the MIDI port to another device. This function also allows you to dump the selected Program as a Program number other than its own.

To dump an individual Program, do the following:

- Connect the MIDI Out of the TSR-24S to the MIDI In of another TSR-24S, computer, or external System Exclusive recording device.
- After entering the MIDI setup menu, press <NEXT> three times. The display reads:

```
 1Bulk Dump
←2Program Dump →
```

- Press Access key <2>. The display reads:

```
Dump 1Prg:1
 2as:1     3Start
```

- Using the Data wheel or the Parameter <+> and <-> keys, select the Program you want to dump out the MIDI port.
- Press Access key <2> and choose the Program number where you want the selected Program dumped.
- Press Access key <3> to start the dump. The display looks something like this:

```
* Sending      *
* Program 7
```

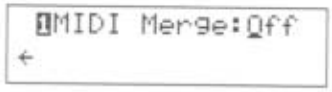
When the dump is finished, you are returned to the Program Dump menu. To exit, press <MIDI>.

MIDI Merge

This option merges any incoming data at the MIDI In port with outgoing TSR-24S data and routes it to the MIDI out jack.

To enable MIDI merging, do the following:

- After entering the MIDI setup menu, press <NEXT> four times. The display reads:



• Press Access key <1> to turn MIDI merging on or off. Press <MIDI> to exit to Performance mode.

Section 7 - Appendix

Memory Usage Chart

Following is a list of all the Modules available in the TSR-24S and amount of both RAM and CPU memory each Module requires. The values shown next to each Module are close but nevertheless approximate, due to the fact that there are several other types of memory involved in the process of building an Algorithm. For the sake of simplicity, we've condensed these several different types into two basic groups: RAM and CPU blocks.

There are instances where you'll think you may just be able to squeeze another Module into an Algorithm (according to the memory usage chart), when the display of the TSR-24S will tell you that it won't fit. If any one of the memory types are completely used, the TSR-24S will tell you that the Module won't fit.

IMPORTANT: When you start building your own Algorithms, remember that the TSR-24S's system software requires about 28 CPU blocks for the master mix control and miscellaneous input and output routing. This gives you a working total of about 228 CPU blocks (484 CPU blocks on a PPC-200 equipped TSR-24S) and 256 RAM blocks to work with.

Module Name	RAM	CPU
EQUALIZERS		
6-Band Graphic	0	51
10-Band Graphic	0	81
15-Band Graphic	0	114
Low-Pass Filter	0	11
High-Pass Filter	0	11
Band-Pass Filter	0	11
Notch Filter	0	12
1-Band Parametric	0	14
3-Band Parametric	0	30
5-Band Parametric	0	47
REVERBS		
ExaVerb	208	213
VeraVerb	170	225
GigaVerb+	228	220
GigaVerb	191	225
Stereo GigaVerb	157	221
BigVerb	79	119
Stereo BigVerb	65	136
MFX Reverb	30	69
Gated Reverb	62	135
Stereo Gated Reverb	85	217
DELAYS		
Mono Delay 0.5	24	12
Stereo Delay 0.5	47	18
2-Tap Delay 0.5	24	16
4-Tap Delay 0.5	24	24
Mono Delay 1.0	47	12
Stereo Delay 1.0	94	18
2-Tap Delay 1.0	47	16
4-Tap Delay 1.0	47	24
Mono Delay 2.0	94	12
Stereo Delay 2.0	188	18
2-Tap Delay 2.0	94	16
4-Tap Delay 2.0	94	24
Mono Delay 5.0	235	12
2-Tap Delay 5.0	235	16
4-Tap Delay 5.0	235	24
Modulated Delay	97	48
Stereo Modulated Delay	102	62
SAMPLERS		
Sampler 2.5	118	98
Sampler 5.0	235	98
Stereo Sampler 2.5	235	110
CHORUSES		
Mono Chorus	10	50
Dual Chorus	10	62
4-Phase Chorus	10	82
Stereo Chorus	19	66
FLANGERS		
Mono Flange	10	54
Dual Flange	19	68
4-Phase Flange	38	96
Stereo Flange	19	70
PITCH SHIFTERS		
Mono Pitch Shift	13	60
Dual Pitch Shift	13	110
Stereo Pitch Shift	25	78

Module Name	RAM	CPU
Mono Detune	9	44
Dual Detune	9	62
Stereo Detune	17	64
Stereo Dual Detune	17	100
4-Voice Detune	9	158
Arpeggiator	78	58
Stereo Arpeggiator	156	84
NOISE REDUCTION / GATES		
Silencer™ Noise Gate	1	12
Stereo Noise Gate	1	14
Silencer™ Noise Red.	1	12
Stereo Silencer™ NR	1	14
PHASERS		
Mono Phaser	2	46
Dual Phaser	2	48
Stereo Phaser	2	68
4-Voice Phaser	8	100
TREMOLOS / AUTO PANNERS		
Mono Tremolo	0	15
Stereo Tremolo	0	18
Auto Panner	0	24
4 Way Auto Panner	0	34
OTHER		
Phase Inverter	0	4
Traditional Wah	0	11
Automatic Wah	0	49
Mono Ducker	0	28
Stereo Ducker	0	32
Tuning Reference	0	15
Whammy™	76	57
Programmable Wham.	76	58
MIXERS		
2x1 Mixer	0	5
3x1 Mixer	0	6
4x1 Mixer	0	7
5x1 Mixer	0	8
6x1 Mixer	0	9
7x1 Mixer	0	10
8x1 Mixer	0	11
10x1 Mixer	0	13
2x2 Mixer	0	8
3x2 Mixer	0	10
4x2 Mixer	0	13
5x2 Mixer	0	15
6x2 Mixer	0	17
7x2 Mixer	0	19
8x2 Mixer	0	21
10x2 Mixer	0	22
12x2 Mixer	0	29
14x2 Mixer	0	31
16x2 Mixer	0	37
2x3 Mixer	0	6
3x3 Mixer	0	8
4x3 Mixer	0	10
5x3 Mixer	0	12
6x3 Mixer	0	14
7x3 Mixer	0	16

Factory Program List

Following is a list of all the factory Programs in the TSR-24S, along with the suggested application for the Program, the input routing configuration of the assigned Algorithm, and the Algorithm number used with the Program.

Prog#	Program Name	Application / Input Mode	Alg#
1	Big & Brite Rev	Instrument-Mono In	1
2	Killer Chorus	Guitar-Mono In	20
3	Wandering Delays	Instrument-Mono In	19
4	Fantasia Guitar	Guitar-Mono In	16
5	Icy Cavern	Instrument-Mono In	4
6	BreathyVerb	Instrument-Mono In	25
7	Big Chorus D	Guitar-Mono In	10
8	RotoTrems	Instrument-Mono In	19
9	South of Heaven	Instrument-Mono In	9
10	Bright Detune	Guitar-Mono In	8
11	TSR Hall-Long	Studio/Live-Stereo In	2
12	TSR Hall-Med	Studio/Live-Stereo In	2
13	TSR Hall-Short	Studio/Live-Stereo In	2
14	TSR Church-Long	Studio/Live-Stereo In	2
15	TSR Church-Med	Studio/Live-Stereo In	2
16	TSR Church-Short	Studio/Live-Stereo In	2
17	TSR Chamber-Long	Studio/Live-Stereo In	2
18	TSR Chamber-Med	Studio/Live-Stereo In	2
19	TSR Chamber-Shrt	Studio/Live-Stereo In	2
20	Hall-Long	Studio/Live-Mono In	25
21	Hall-Med	Studio/Live-Mono In	25
22	Hall-Short	Studio/Live-Mono In	25
23	Church-Long	Studio/Live-Mono In	23
24	Church-Med	Studio/Live-Mono In	23
25	Church-Short	Studio/Live-Mono In	23
26	Chamber-Long	Studio/Live-Mono In	23
27	Chamber-Med	Studio/Live-Mono In	23
28	Chamber-Short	Studio/Live-Mono In	23
29	Plate-Long	Studio/Live-Mono In	23
30	Plate-Med	Studio/Live-Mono In	23
31	Plate-Short	Studio/Live-Mono In	23
32	Thin Plate-Long	Studio/Live-Mono In	23
33	Thin Plate-Med	Studio/Live-Mono In	23
34	Thin Plate-Short	Studio/Live-Mono In	23
35	SnarePlate-Long	Studio/Live-Mono In	23
36	SnarePlate-Med	Studio/Live-Mono In	23
37	SnarePlate-Short	Studio/Live-Mono In	23
38	VocalPlate-Long	Studio/Live-Mono In	23
39	VocalPlate-Med	Studio/Live-Mono In	23
40	VocalPlate-Short	Studio/Live-Mono In	23
41	VocalChambr-Long	Studio/Live-Mono In	23

Prog#	Program Name	Application / Input Mode	Alg#
42	VocalChambr-Med	Studio/Live-Mono In	23
43	VocalChambr-Shrt	Studio/Live-Mono In	23
44	Wood Room-Long	Studio/Live-Mono In	23
45	Wood Room-Med	Studio/Live-Mono In	23
46	Wood Room-Short	Studio/Live-Mono In	23
47	StudioRoom-Long	Studio/Live-Mono In	25
48	StudioRoom-Med	Studio/Live-Mono In	25
49	StudioRoom-Short	Studio/Live-Mono In	25
50	ClubRoom-Long	Studio/Live-Mono In	23
51	ClubRoom-Short	Studio/Live-Mono In	23
52	SoundStage-Long	Studio/Live-Mono In	21
53	SoundStage-Short	Studio/Live-Mono In	21
54	Garage-Med	Studio/Live-Mono In	23
55	Arena-Med	Studio/Live-Mono In	23
56	GatedRvrb-Long	Studio/Live-Mono In	21
57	GatedRvrb-Short	Studio/Live-Mono In	21
58	RvGatedRvrb-Long	Studio/Live-Mono In	21
59	Left->Right Rvrb	Studio/Live-Mono In	21
60	Real Gated Rvrb	Studio/Live-Mono In	18
61	L)Small R)Brite	Studio/Live-Dual Mono In	12
62	L)VoxVerb R)Sprd	Studio/Live-Mono In	11
63	Live DlyRev Quad	Studio/Live-Mono In	17
64	DlyChor 4 Keys	Instrument-Mono In	3
65	Dream Sequence	Instrument-Mono In	13
66	Rubbery	Guitar-Mono In	7
67	Syn String Gtr	Guitar-Mono In	16
68	Bored On Da Bi U	Guitar-Mono In	19
69	Nashville Now	Guitar-Mono In	8
70	Gtr Power Octave	Guitar-Mono In	5
71	AutoWah/PhaseDly	Guitar-Mono In	22
72	Stereo -> Quad	Studio/Live-Stereo In	24
73	EQ'd Delay Lines	Studio/Live-Stereo In	6
74	Mono Sampler 5.0	Studio/Live-Stereo In	14
75	TS 2.5Sec Smplr	Studio/Live-Stereo In	15
76	TS Chorus	Studio/Live-Stereo In	3
77	TS Flange	Studio/Live-Stereo In	4
78	TS PitchShift	Studio/Live-Stereo In	5
79	TS Detune	Studio/Live-Stereo In	5
80	TS 2 Sec Delay	Studio/Live-Stereo In	3
81	Chorus-2v Deep	Studio/Live-Mono In	19
82	Chorus-2v Med	Studio/Live-Mono In	19
83	Chorus-4v Deep	Studio/Live-Mono In	20
84	Chorus-4v Med	Studio/Live-Mono In	20
85	Chorus-8v Deep	Studio/Live-Mono In	20
86	Chorus-8v Med	Studio/Live-Mono In	20
87	Flange-2v Deep	Studio/Live-Mono In	4

Prog#	Program Name	Application / Input Mode	Alg#
88	Flange-2v Med	Studio/Live-Mono In	4
89	Phaser-2v Deep	Studio/Live-Mono In	22
90	Phaser-2v Med	Studio/Live-Mono In	22
91	Detune-1v Deep	Studio/Live-Mono In	8
92	Detune-1v Med	Studio/Live-Mono In	8
93	Detune-2v Deep	Studio/Live-Mono In	8
94	Detune-2v Med	Studio/Live-Mono In	8
95	Pitch-OctaveUp	Studio/Live-Mono In	16
96	Pitch-OctaveDown	Studio/Live-Mono In	16
97	Pitch-OctUp+Down	Studio/Live-Mono In	16
98	Pitch-5thUp	Studio/Live-Mono In	16
99	Pitch-4thDown	Studio/Live-Mono In	16
100	Delay-1Tap 300ms	Studio/Live-Mono In	16
101	Delay-2Tap 300ms	Studio/Live-Mono In	16
102	Delay-4Tap 300ms	Studio/Live-Mono In	16
103	Mod Delay 500m	Studio/Live-Mono In	22
104	Mod Delay 300m	Studio/Live-Mono In	22
105	Tremolo-Med	Studio/Live-Mono In	19
106	AutoPan-Med	Studio/Live-Mono In	19
107	Leslie-Fast	Studio/Live-Mono In	19
108	Leslie-Slow	Studio/Live-Mono In	19
109	Arpeggiate-Up	Studio/Live-Mono In	13
110	Tone Generator	Studio/Live-Mono In	24
111	Muted	Studio/Live-Mono In	24
112	Bypassed	Studio/Live-Mono In	24
PPC-200 Users Only			
113	L)Plate R)Room	Studio/Live-Dual Mono In	32
114	L)Snare R)Kick	Studio/Live-Dual Mono In	31
115	L)Hall R)SmlRoom	Studio/Live-Dual Mono In	30
116	L)Brite R)Dark	Studio/Live-Dual Mono In	30
117	TS ExaHall	Studio/Live-Stereo In	30
118	TSExaRoom	Studio/Live-Stereo In	30
119	Split ExaPlate	Studio/Live-Mono In	30
120	Split Hi/Lo Verb	Studio/Live-Mono In	30
121	Chorus In Motion	Instrument-Mono In	29
122	Old Meets New	Instrument-Mono In	28
123	Outer Limits	Instrument-Mono In	28
124	Bag Of Tricks	Instrument-Mono In	27
125	Shuddered Room	Instrument-Mono In	29
126	Good ol' Days	Instrument-Mono In	28
127	Hall of Chorus	Instrument-Mono In	29
128	***Modulation***	Instrument-Mono In	27

Glossary of Terms

Access Keys - 4 user-programmable buttons on the front panel of the TSR-24S that allow instant access to specific Parameters and menus.

Algorithm - Often called a configuration, an Algorithm is a group of effects (like chorus, reverb, flange, delay, pitch shift) combined to create or produce certain sounds. You can write your own Algorithms with the TSR-24S by combining effects, in any order, or you can use the factory Algorithms that are used by the factory Programs.

Edit mode - The only mode where changes to Algorithms (addition or deletion of Modules, signal path routing) can be made.

Effects Modules (FX Modules) - Components, such as chorus, reverb, delay, or pitch shifting, that are selected by the Algorithm writer (either you or the factory) and placed into one location. Effects Modules are the building blocks of Algorithms.

Factory Programs - Preset sounds that have been written by the factory for the owner's use. Factory Programs can be used as a starting point to create unique custom sounds, and user-modified Programs can be stored in a separate location for easy recall using the front panel, a footswitch, or via MIDI. These modified Programs are called "User Programs."

Mixer Module - The means by which more than one output of an effects Module or Modules can be combined into a single signal path before going into another effects Module.

Parameter - Adjustable settings of each of the components of an effect Module that, in combination, make up Programs.

Performance mode - The 'default' mode, or normal operating mode of the TSR-24S. When the unit is turned on, it automatically defaults to Performance mode.

Program - The Parameters associated with each effect Module, set at desired values to produce a specific sound, and stored in a memory location of the TSR-24S.

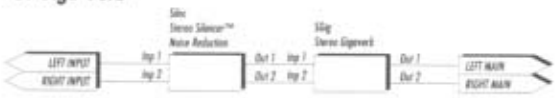
Program modification - Altering of the values of effects Module Parameters.

Factory Algorithm Routing Diagrams

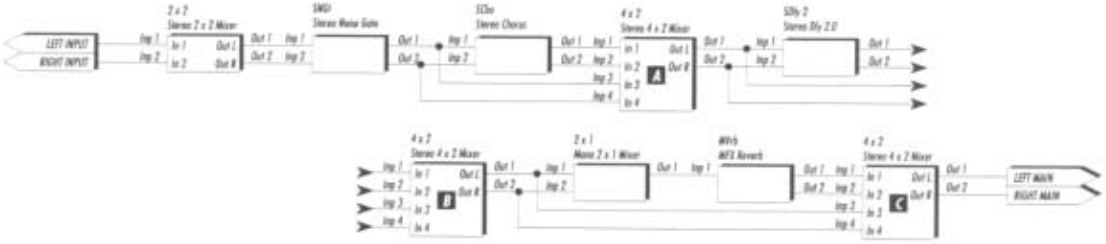
Following are block diagrams of all the Factory Algorithms. These diagrams show all of the input and output information associated with each Module and the signal path routings for each of the 32 factory Algorithms. Algorithms 27 - 32 are only available when a PPC-200 is installed.

Algorithm #1
Giga Verb 1 -> 4

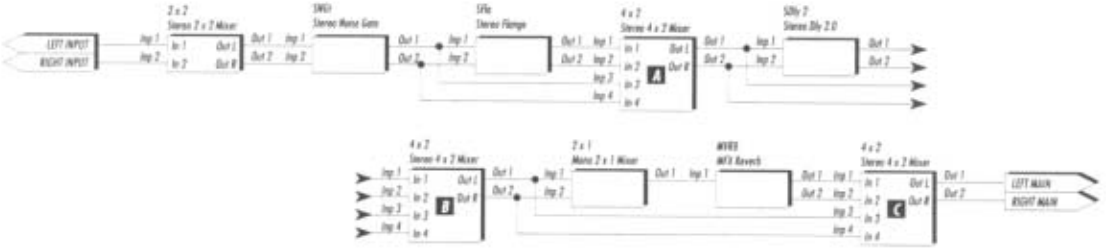
Algorithm #2
St Giga Verb



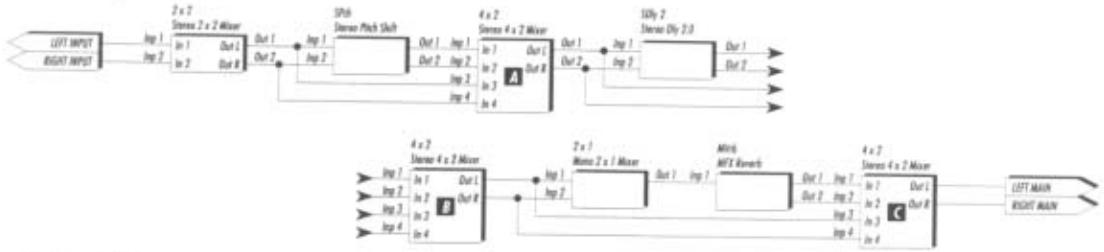
Algorithm #3
St Cho -> Dly -> Rev



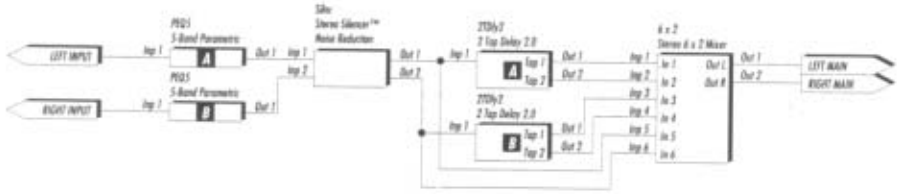
Algorithm #4
St Fla -> Dly -> Rev



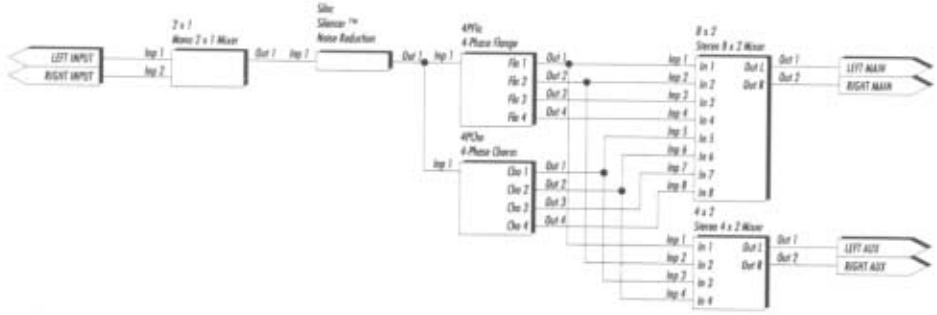
Algorithm #5
St Pch -> Dly -> Rev



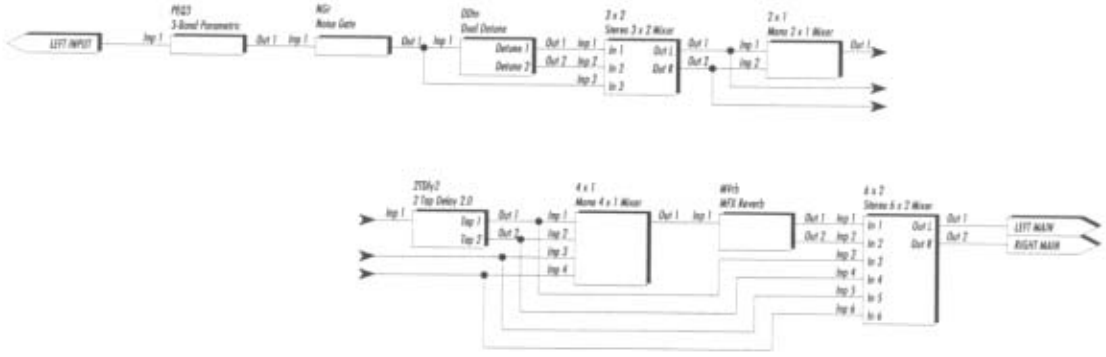
Algorithm #6
St 5 BndPEQ 2TDl



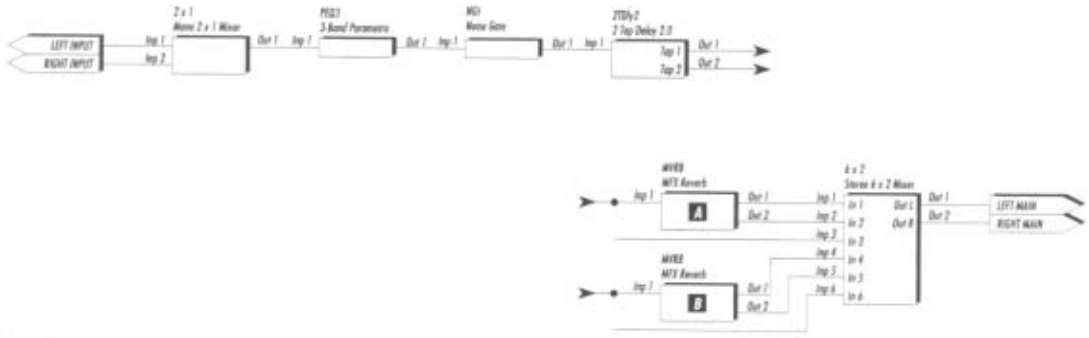
Algorithm #7
4Phase Cho & Fla



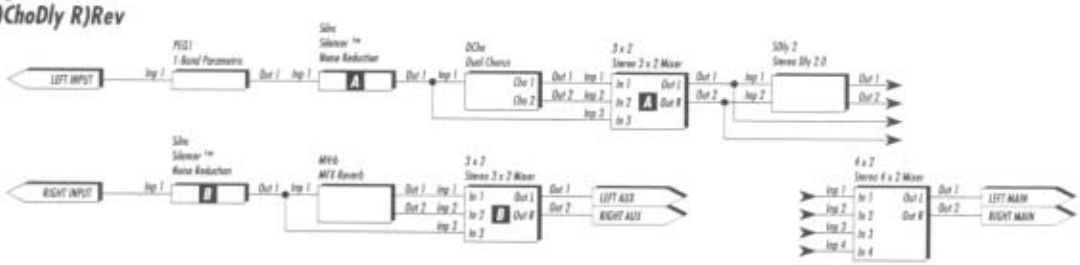
Algorithm #8
Det -> 2Tap Rev



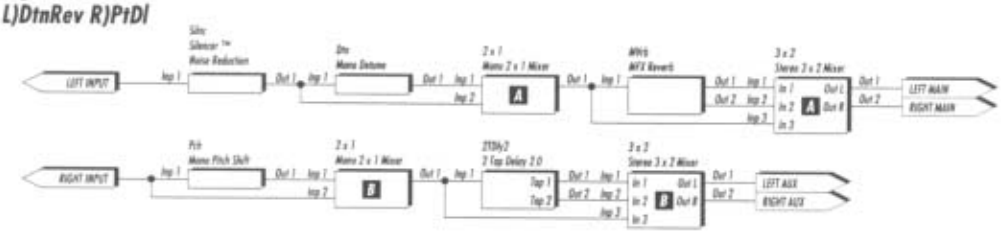
Algorithm #9
2TDly -> 2 Reverbs



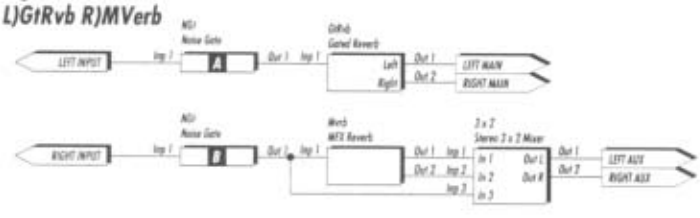
Algorithm #10
L)ChoDly R)Rev



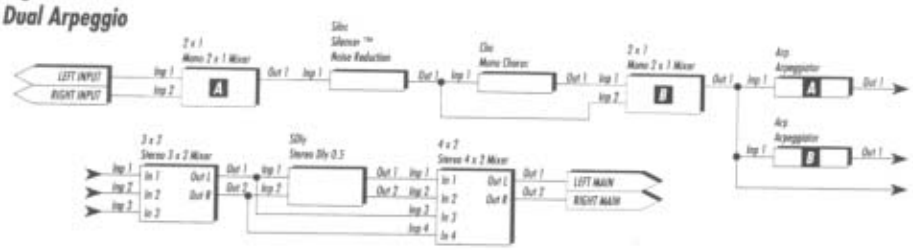
Algorithm #11
L)DtnRev R)PtDl



Algorithm #12
L)GtRvb R)MVerb

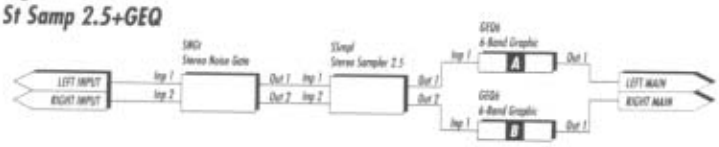


Algorithm #13
Dual Arpeggio

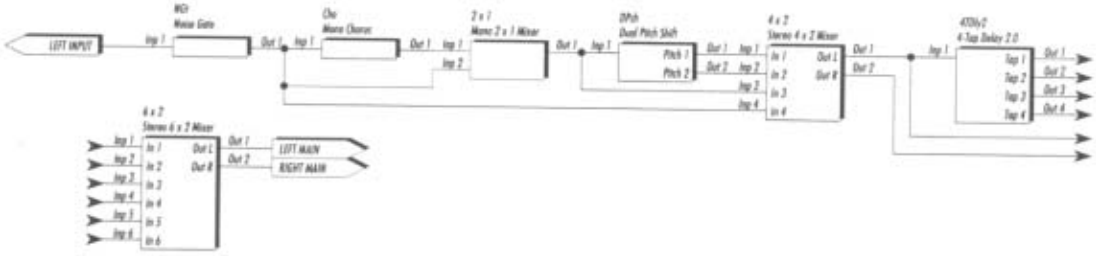


Algorithm #14
Sampler 5.0+GEQ

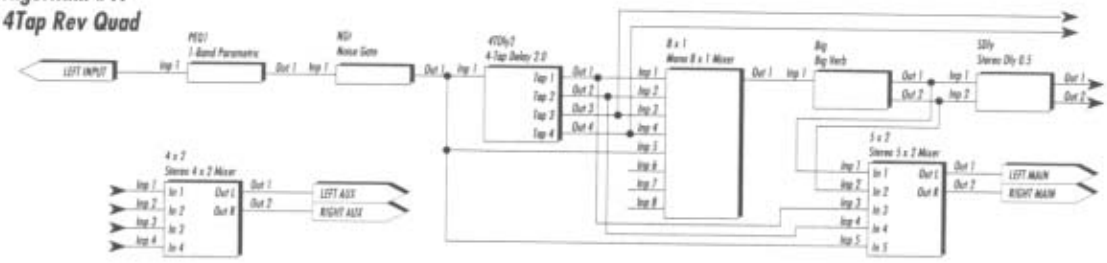
Algorithm #15
St Samp 2.5+GEQ



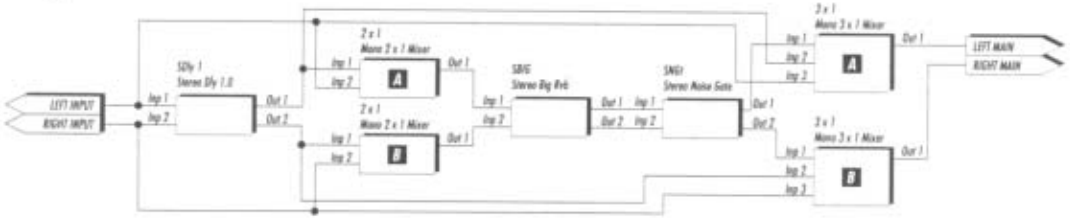
Algorithm #16
Cho->Pch->4-Tap



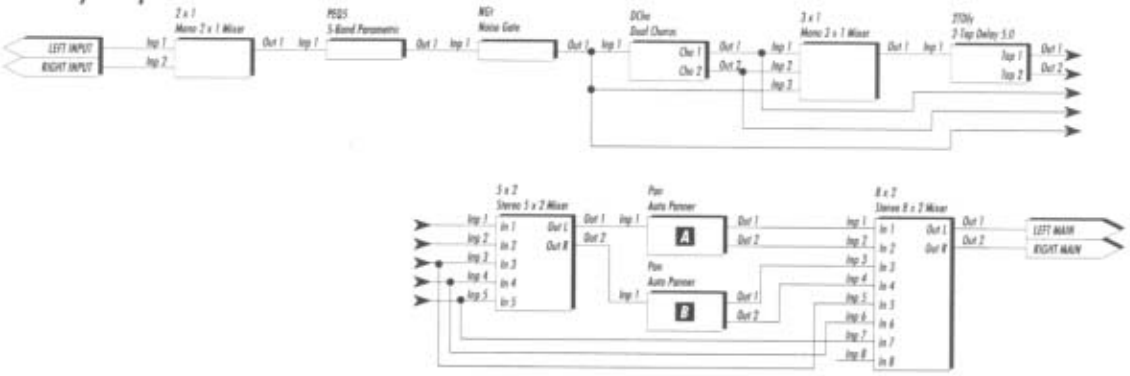
Algorithm #17
4Tap Rev Quad



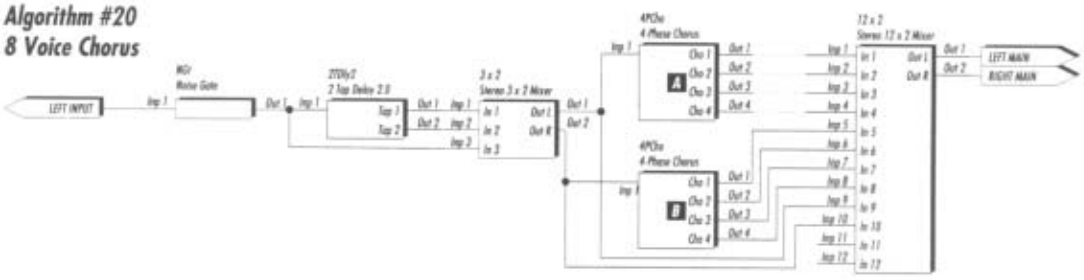
Algorithm #18
St Dly->Rev->NGt



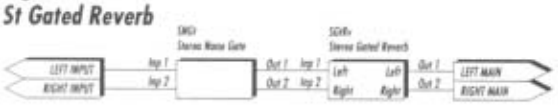
Algorithm #19
Cho->Dly Autopan



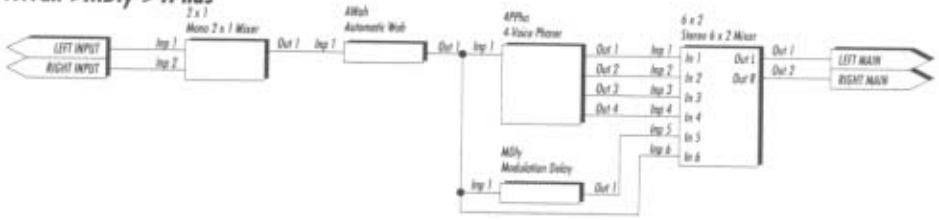
Algorithm #20
8 Voice Chorus



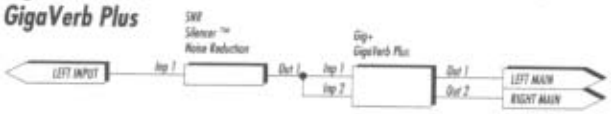
Algorithm #21
St Gated Reverb



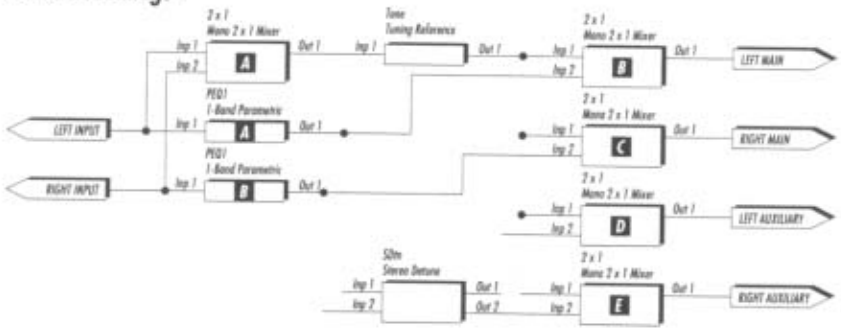
Algorithm #22
AWah->MDly->4Phas



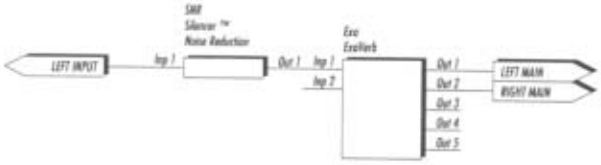
Algorithm #23
GigaVerb Plus



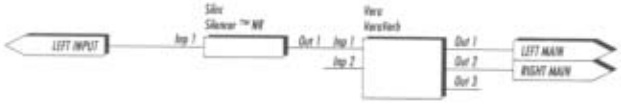
Algorithm #24
Tone&QuadImage



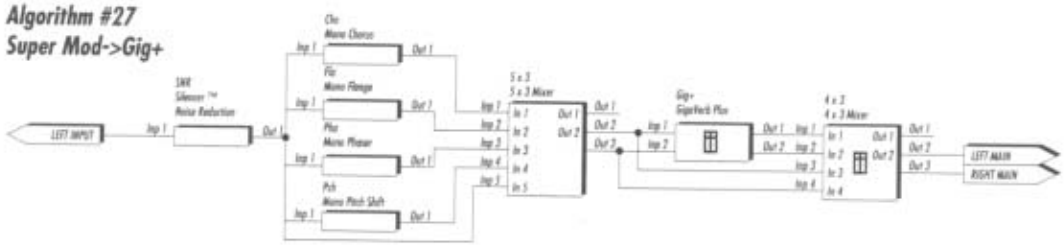
Algorithm #25
ExaVerb



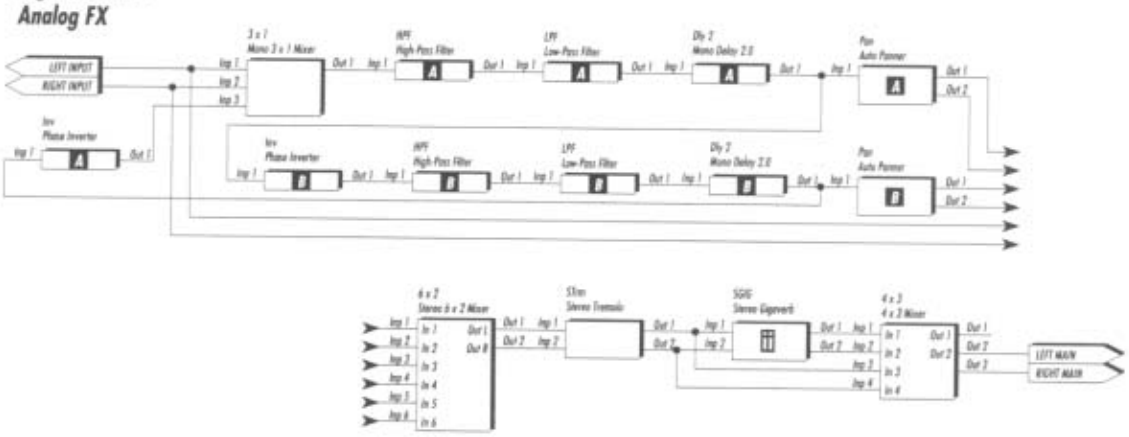
Algorithm #26
VeraVerb



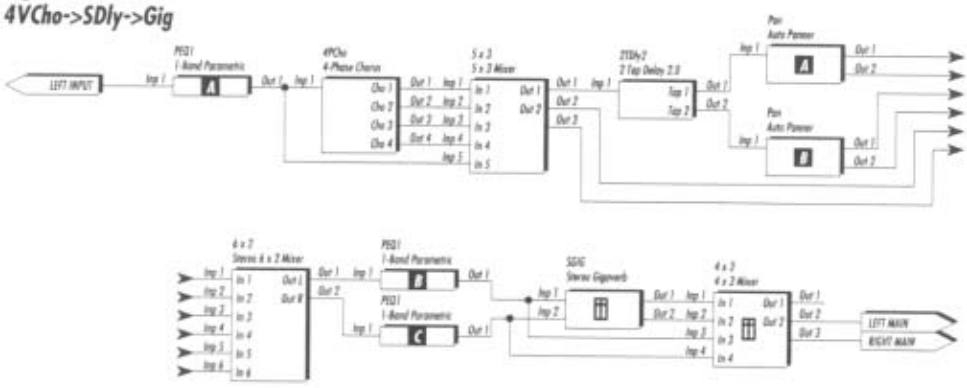
Algorithm #27
Super Mod->Gig+



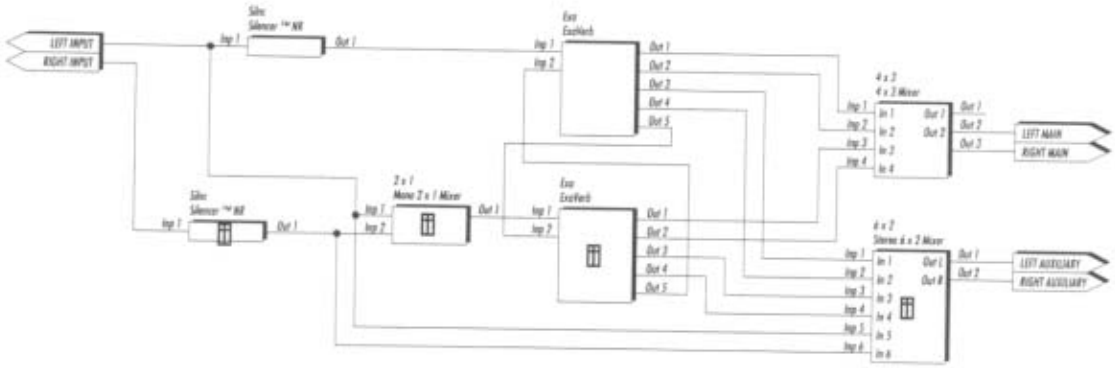
Algorithm #28
Analog FX



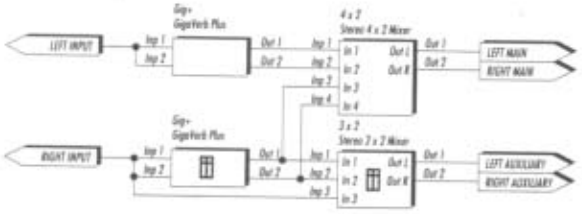
Algorithm #29
4VCho->SDly->Gig



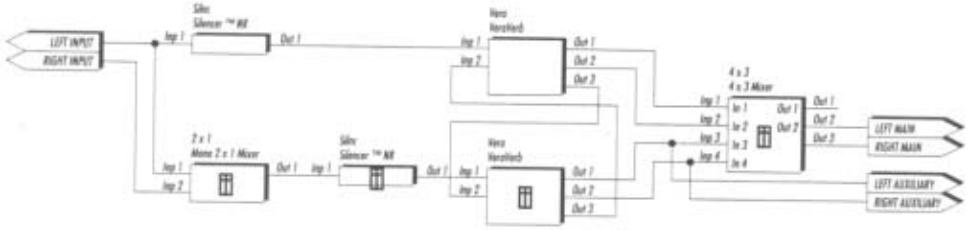
Algorithm #30
Double ExaVerb



Algorithm #31
Double GigaVerb+

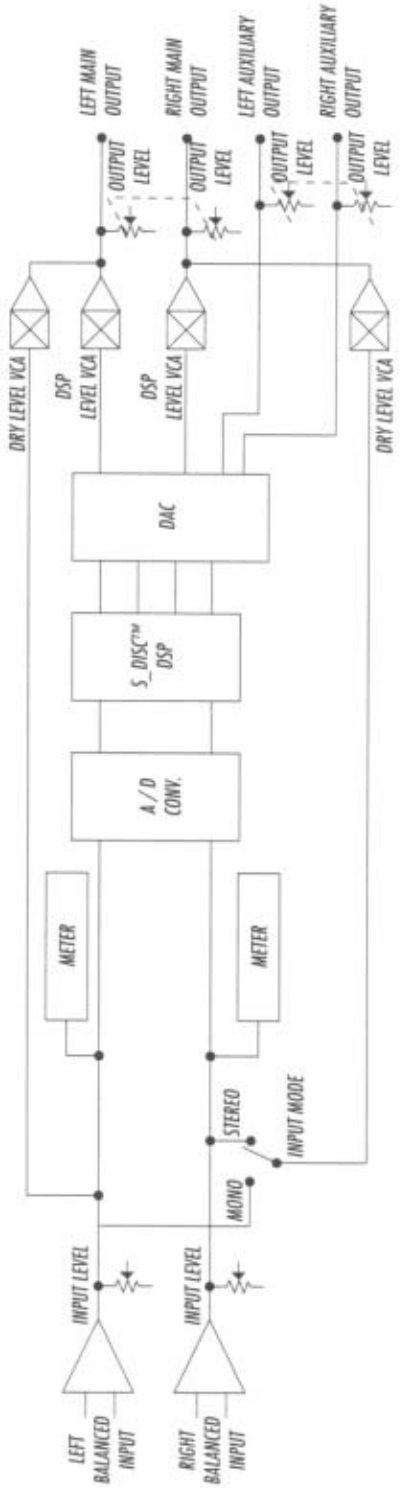


Algorithm #32
Double VeraVerb



TSR-24S Block Diagram

Following is a simplified block diagram of the TSR-24S signal path:



MIDI Implementation Chart

Function...		Transmitted	Recognized	Remarks
Basic Channel	Default Channel	1-16 1-16	1-16 1-16	Memorized
Mode	Default Messages Altered	Mode 3 X	Mode 3 X	Omni Off
Note Number	True Voice	X	X	
Velocity	Note ON Note OFF	X X	X X	Not Recognized
After Touch	Key's Ch's	X X	X X	
Pitch Bender		X	X	
Control Change		X	O	
Prog Change	True #	0-127	0-127 1-128	Internally Mapped
System Exclusive		O	O	
System Common	:Song Pos :Song Sel :Tune	X X X	X X X	
System Real Time	:Clock :Commands	X X	X X	
Aux Mes-sages	:Local ON/OFF :All Notes Off :Active Sense :Reset	X X X X	X X X X	
Notes				

Mode 1 : OMNI ON, POLY
Mode 2 : OMNI ON, MONO
Mode 3 : OMNI OFF, POLY
Mode 4 : OMNI OFF, MONO

O : Yes
X : No

Specifications

A/D Converter: 18 bit, 128 x oversampled delta-sigma stereo A/D converter

D/A Converter: 18 bit PCM D/A converter

Sampling Frequency: 48 kHz

DSP Section:

Architecture: .....Static-Dynamic Instruction Set Computer (S-DISC™)
Digital Signal Path Width: .....24 bits (144.5 dB)
Internal Data Path Width: .....48 bits (289 dB)
Dynamic Delay Memory: .....256k x 24 bits (5.46 seconds)
Static Delay Memory: .....256 24-bit registers (5.33 milliseconds)
Data ALU Processing:.....12.3 MIPS
Address ALU Processing:.....18.4 MIPS
Multiplier Size:.....24 bits x 24 bits

Input Section:

Connector: 1/4" Balanced TRS
Nominal Level: +4 dBu
Maximum Level: +18 dBu
Impedance: 10 kohms unbalanced, 20 kohms balanced

Output Section:

Connector: 1/4" TRS
Nominal Level: +4 dBu
Maximum Level: +18 dBu
Impedance: 50 ohms

General:

Frequency Response: 20 Hz. - 20 kHz. ±0.5 dB
S/N ratio: Greater than 90 dB; ref = max signal, 22 kHz measurement bandwidth
Total Harmonic Distortion: Less than 0.03% (1 kHz.)
Memory Capacity:
- Factory: 256 Programs, 20 Algorithms
- User: 256 Programs, 32 Algorithms
- PPC-200 Equipped: 32 factory Algorithms

Power Requirements:
- US and Canada:.....120 VAC, 60 Hz
- Japan:.....100 VAC, 50/60 Hz
- Europe:.....230 VAC, 50 Hz
- UK:.....240 VAC, 50 Hz

Power Consumption:.....30 watts
Dimensions: .....19"(482 mm) W x 1.75"(44 mm) H x 9"(229 mm) D
Net Weight: .....7.65 lbs. (3.48 kg.)
Shipping Weight:.....11 lbs. (5 kg.)

8760 South Sandy Parkway
Sandy, Utah, 84070

Telephone (801) 566-8800
FAX (801) 566-7005

International Distribution: 3 Overlook Drive Unit 4
Amherst, New Hampshire 03031 U.S.A.
FAX (603) 672-4246

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