

RSB-18 / RSB-12 ROCKTRON/BRADSHAW SWITCHING SYSTEMS

OPERATORS MANUAL

V1.0 software

U.S. Patents # 4,647,876
and 4,696,044.
Other patents pending.
Foreign patents pending.



INTRODUCTION

Please read this entire manual before attempting to operate the system.

As the music industry has taken on new technologies and has become more intricate and involved, it became obvious to me that musicians were in need of something convenient to organize, route and coordinate their tools of their trade, and allow them to be free to concentrate on music.

This switching system is a culmination of nearly a decade of my experience and the collaboration with the engineers at Rocktron. Together we have jointly designed and developed the ultimate switching system with immense organizational power in its program capacities and its direct access to each component in the signal path. Its features make it a very performance oriented system that has no tonal qualities of its own, but was designed to be completely transparent.

Don't hesitate to experiment and try different routings and configurations. Find new ways to use the system. It was designed to be extremely flexible for changing, updating and re-configuring equipment. These experimentations can lead to great innovations and will make the system unique to the individual. Have fun with it!!!

A handwritten signature in black ink, appearing to read "Bob Bradshaw". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

The Rocktron/Bradshaw Switching Systems are designed to be the finest effects switching systems made. This joint development effort between Bob Bradshaw and Rocktron makes the legendary Bradshaw system used by top performers available to every guitarist.

This operating manual will introduce you to the Rocktron/Bradshaw Switching Systems and their various functions. After reading this manual carefully, keep it for future reference.

PRECAUTIONS

NOTE: IT IS VERY IMPORTANT THAT YOU READ THIS SECTION TO PROVIDE YEARS OF TROUBLE FREE USE. THIS UNIT REQUIRES CAREFUL HANDLING.

All warnings on this equipment and in the operating instructions should be adhered to and all operating instructions should be followed.

Do not use this equipment near water. Care should be taken so that objects do not fall and liquids are not spilled into the unit through any openings.

The power cord should be unplugged from the outlet when unused for a long period of time.

DO NOT ATTEMPT TO SERVICE THIS EQUIPMENT. THIS EQUIPMENT SHOULD BE SERVICED BY QUALIFIED PERSONNEL ONLY. DO NOT REMOVE THE COVER FROM THIS EQUIPMENT AT ANY TIME. DO NOT MAKE ANY INTERNAL ADJUSTMENTS OR ADDITIONS TO THIS EQUIPMENT AT ANY TIME. DO NOT TAMPER WITH INTERNAL ELECTRONIC COMPONENTS AT ANY TIME. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY VOID WARRANTY SERVICE TO THIS EQUIPMENT, AS WELL AS CAUSING SHOCK HAZARD.

Do not plug the output from a power amplifier directly into any of the inputs on the switching system! Doing so may result in damage to the unit. Use a power load device such as the Rocktron/Holdsworth Juice Extractor to interface between a power amp and the line level inputs of this unit.

VOLTAGE RATINGS

Make sure your AC outlet satisfies the voltage rating to avoid damage to this unit. The back of this unit will be rated one of the following:

JAPAN:	100 V 50/60Hz
US/CANADIAN:	115 V 50/60Hz
GERMANY/FRANCE/FINLAND:	220-240 V 50/60Hz

OPERATING TEMPERATURE

Do not expose this unit to excessive heat. This unit is designed to operate between 32 F and 104 F (0 C and 40 C). This unit may not function properly under extreme temperatures.

CLEANING

Do not use solvents such as benzine, etc. to clean the exterior. Use a soft dry cloth to remove dust, dirt, or fingermarks.

RSB-18R AND RSB-12R RACK FRONT PANEL DESCRIPTION

The Rocktron/Bradshaw Switching Systems are professional MIDI programmable effects switching and control systems. The minimum system requirements consists of a rack unit, and a single footswitch. The rack unit alters the audio path through multiple effects units via commands from the footswitch. Up to three footswitches may be used in a system. The rack unit is available in two different models, the RSB-18R and the RSB-12R. The footswitch unit is also available in two different models, the RSB-18F and the RSB-12F.

(1) . . **INPUT JACK:** standard 1/4" mono

This standard unbalanced mono 1/4" jack is used to provide input to the unit. It is front panel mounted for easy access. Read the SPECIFICATIONS section to determine the maximum input level.

(2) . . **PROGRAMMABLE HUSH LED:**

When lit, this LED indicates that the Programmable HUSH is in use.

(3) . . **STEREO LOOP 11 LED:**

When lit, this LED indicates that the Stereo Loop 11 is in.

(4) . . **STEREO LOOP 11 DIRECT SWITCH:**

This switch allows the selection of the direct signal of the stereo loop to be ON (switch in), or ALT (switch out). When the switch indicates ON, the direct signal is always present, and the signal of the effect inserted in Loop 11 can be mixed in with the direct signal. When the switch indicates ALT., the direct signal is either present OR the signal of the effect inserted in Loop 11 is present.

(5) . . **STEREO LOOP 11 LEFT MIX LEVEL CONTROL:** Variable

The Left Mix Level control adjusts the amount of left signal from the effect being mixed in with the direct signal when the Direct switch in ON. When the Direct switch is ALT., the Mix Level control adjusts only the level of the effect. The Mix Level control is variable from full attenuation to approximately 5.5dB of gain.

(6) . . **STEREO LOOP 11 RIGHT MIX LEVEL CONTROL:** Variable

The Right Mix Level control adjusts the amount of right signal from the effect being mixed in with the direct signal when the Direct switch is ON. When the Direct switch is ALT., the Mix Level control adjusts only the level of the effect. The Mix Level control is variable from full attenuation to approximately 5.5dB of gain.

(7) . . **LEFT HUSH THRESHOLD CONTROL:** Variable (RSB-18R units only)

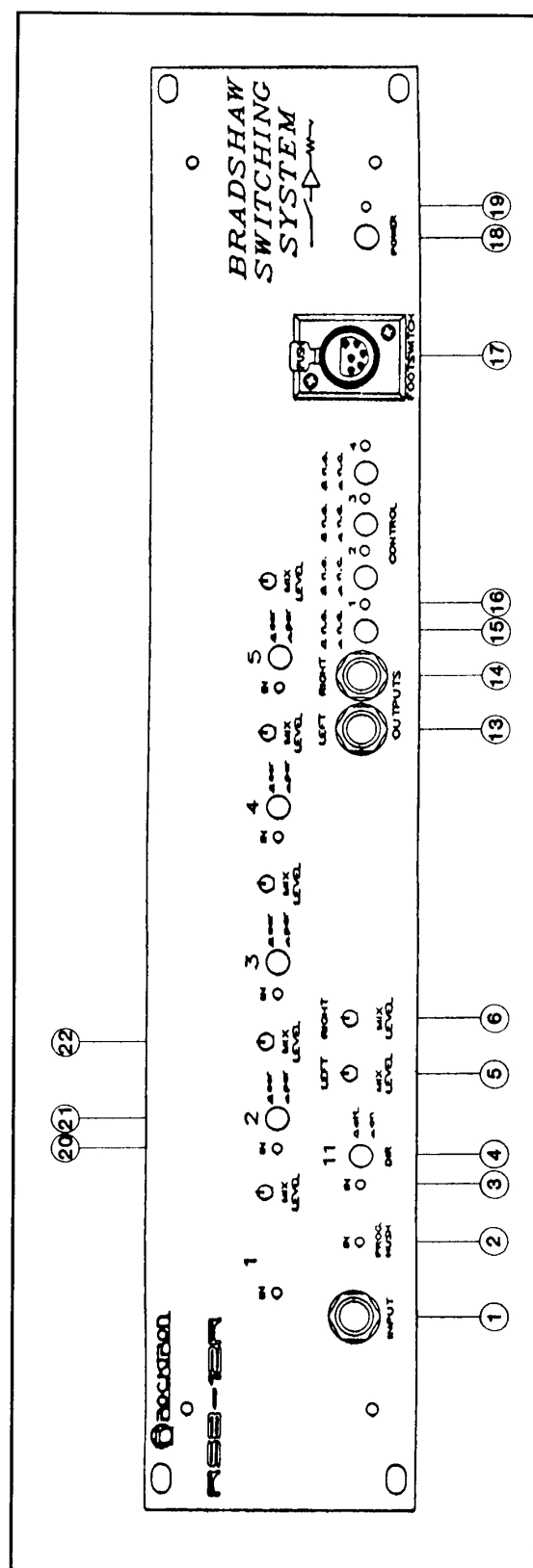
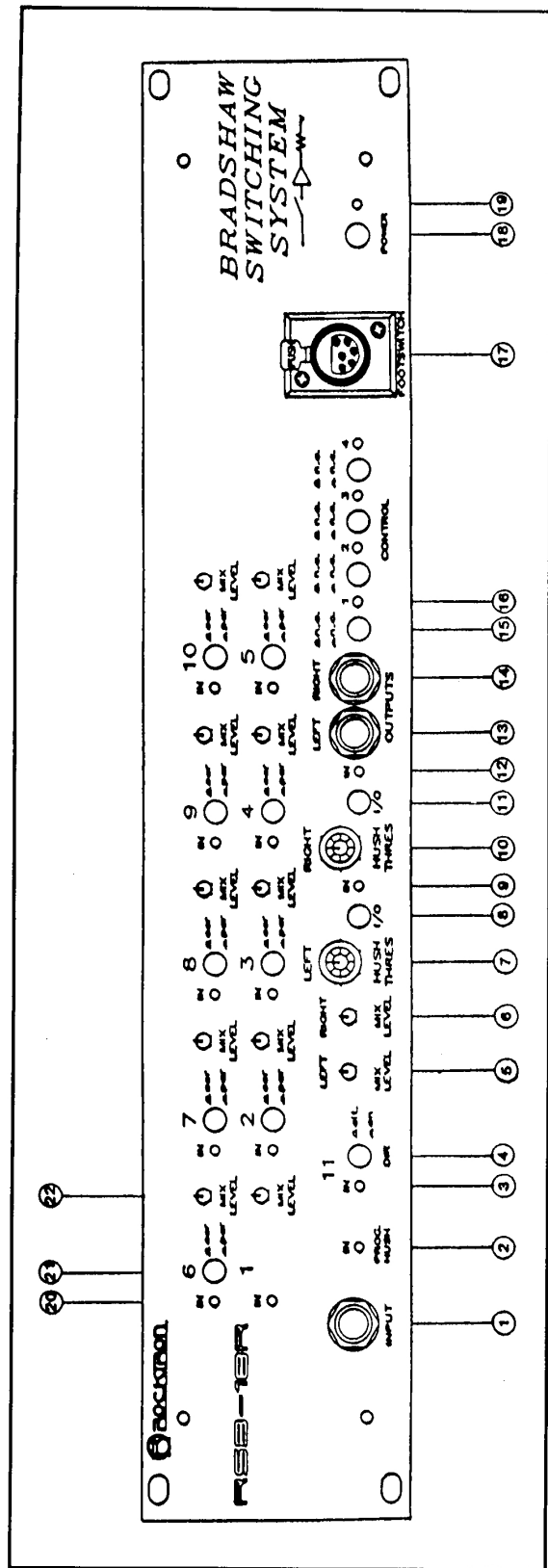
Adjustable between -70 and 0dB, the Left HUSH is normalled (patched in the signal path by default) before the final left output.

(8) . . **LEFT HUSH IN/OUT SWITCH:** (RSB-18R units only)

This switches the Left HUSH In, or Out for bypass.

(9) . . **LEFT HUSH LED:** (RSB-18R units only)

When lit, this LED indicates the Left HUSH is in use.



(10). . . **RIGHT HUSH THRESHOLD CONTROL:** Variable (RSB-18R units only)
Adjustable between -70 and 0dB, the Right HUSH is normalled (patched in the signal path by default) before the final right output.

(11). . . **RIGHT HUSH IN/OUT SWITCH:** (RSB-18R units only)
This switches the Right HUSH In, or Out for bypass.

(12). . . **RIGHT HUSH LED:** (RSB-18R units only)
When lit, this LED indicates the Right HUSH is in use.

(13). . . **LEFT FINAL OUTPUT JACK:** standard 1/4" mono
This standard unbalanced mono 1/4" jack provides the left final output for the system. It is front panel mounted for easy access.

(14). . . **RIGHT FINAL OUTPUT JACK:** standard 1/4" mono
This standard unbalanced mono 1/4" jack provides the right final output for the system. It is front panel mounted for easy access.

(15). . . **CONTROL 1-4 SWITCHES**
The Control jacks are directly connected to relay contacts. This allows these jacks to be used to control outboard devices which have footswitchable functions. These switches allow for the selection of the relay contacts for each of the controls to be configured N.O., (normally open— switch out), or configured N.C., (normally closed—switch in), thereby permitting the footswitching to be in sync with the control switching indication.

(16). . . **CONTROL 1-4 LEDs:**
When lit, each LED indicates the switching status of that control.

(17). . . **FOOTSWITCH AXR JACK:**
This 6-pin AXR jack takes a cord which connects to the RACK AXR jack on the footswitch, providing both power to the footswitch as well as MIDI communication between the two units.

(18). . . **POWER SWITCH:**

(19). . . **POWER LED:**

LOOP CONTROLS

LOOPS 1-10: RSB -18R units

LOOPS 1-5: RSB-12R units

(20). . . **LOOP IN LED:**
When lit, these LEDs indicate the switching status of that loop.

(21). . . **LOOP SER/PAR SWITCH:**
For each loop, except Loop 1, these switches select the configuration of either series connection, or parallel connection of that loop with the previous loop. (i.e. for Loop 3, when the SER/PAR switch indicates PAR, Loop 3 is in parallel with Loop 2.)

(22). . . **LOOP MIX LEVEL:** Variable

These Loop Mix Level controls enable the adjustment of the level of the effect in the loop. When the loop is bypassed (off), the Mix Level control has no effect. The Mix control comes between the return and the output. When using the loop in a Device Mute configuration, the device can be inserted either to include or exclude the Mix control. See the section of PATCHING DEVICES INTO THE LOOPS for more information.

RSB-18R AND RSB-12R RACK REAR PANEL DESCRIPTION

LOOP JACKS

LOOPS 1-10 plus stereo LOOP 11 (left/right): RSB-18R units

LOOPS 1-5 plus stereo LOOP 11 (left/right):RSB-12R units

(1). . . **LOOP IN JACKS:**

These are standard 1/4" mono jacks that are used to provide input to the audio path for each particular loop. Each loop is automatically fed (normalled) from the output of the preceding loop internally, providing no need for external wiring, unless a different configuration is desired. The insertion of a plug into the jack to change the configuration will defeat the automatic internal path at that point in the system.

(2). . . **LOOP SEND JACKS:**

These are standard 1/4" mono jacks that are used to provide switchable outputs to any external device input.

(3). . . **LOOP RETURN JACKS:**

These are standard 1/4" mono jacks that accept the output of any external device. The insertion of a plug will break the internal normalling to the Send jack.

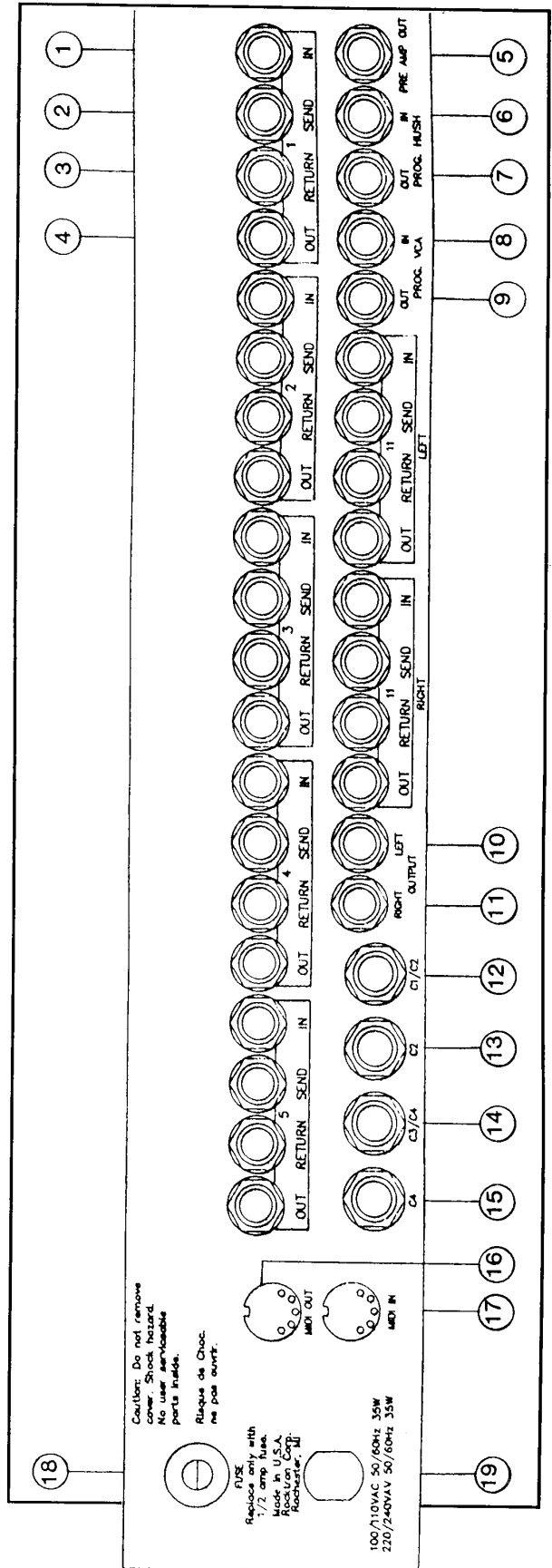
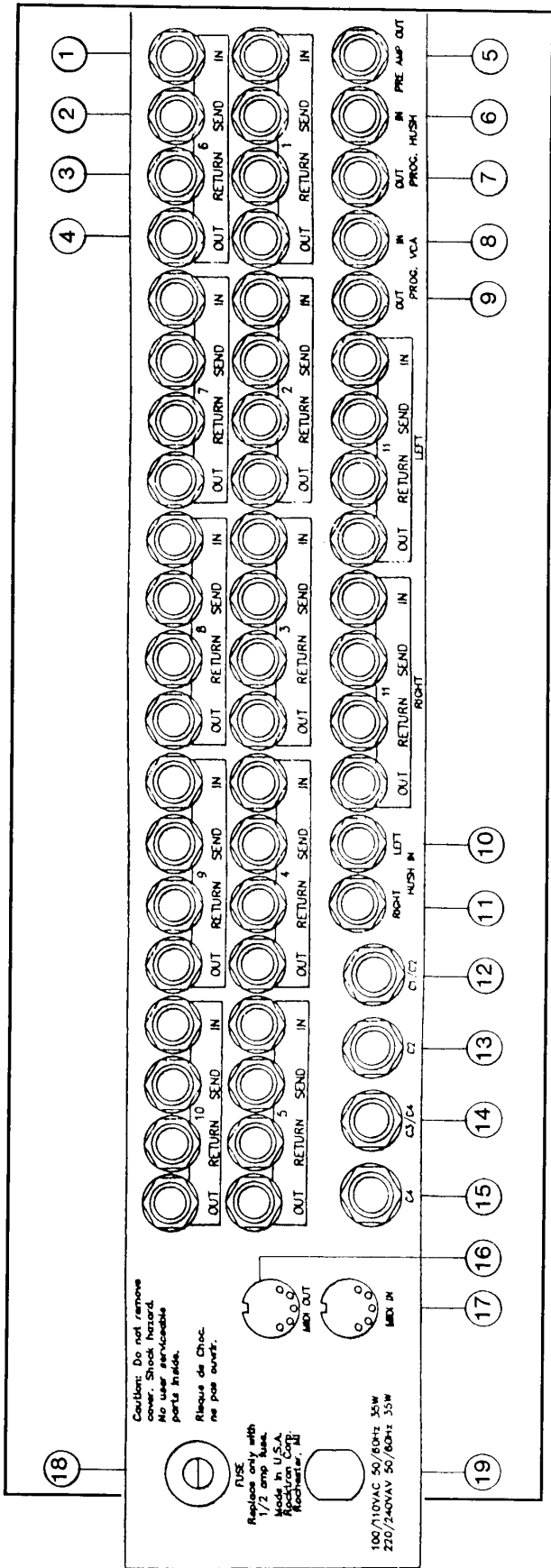
NOTE: The Return jacks are not grounded, for prevention of ground loops. Any external device that is connected to the switching system only via a Return jack must have a separate ground path to prevent hum.

(4). . . **LOOP OUT JACKS:**

These are standard 1/4" mono jacks which provide an output of the audio signal for each individual loop. The output is automatically fed to the input of the next loop internally, requiring no need for external wiring or patching, unless a different configuration is desired.

(5). . . **PRE OUT JACK:**

This standard 1/4" mono jack provides output from the Pre Out stage. This jack will automatically feed the Loop In Jack of Loop 1 internally, requiring no need for external wiring or patching, unless a different configuration is desired. The Pre Out stage has no gain or signal modification qualities.



(6) . . . **PROGRAMMABLE HUSH IN JACK:**

This standard 1/4" mono jack is used to provide a direct input to the Programmable HUSH circuit. This HUSH must be patched at the desired point in the audio path. See the CONNECTIONS section referring to the Programmable HUSH. The Programmable HUSH is externally controlled by the footswitch. Both the Threshold control and the In/Out switching must be activated by the footswitch to function.

(7) . . . **PROGRAMMABLE HUSH OUT JACK:**

This standard 1/4" mono jack provides output from the Programmable HUSH. This jack must be patched into the input of the next stage or loop, for the continuation of the audio path.

(8) . . . **PROGRAMMABLE VCA IN JACK:**

This standard 1/4" mono jack is used to provide a direct input to the Programmable VCA circuit. This VCA must be externally patched at the desired point in the audio path. The Programmable VCA is externally controlled by the footswitch, and must be activated by the footswitch function.

(9) . . . **VCA OUT JACK:**

This standard 1/4" mono jack provides output from the Programmable VCA. This jack must be patched into the input of the next stage or loop, for the continuation of the audio path.

(10) . . . **LEFT HUSH IN JACK:** (RSB-18R units only)

. . . **LEFT OUTPUT JACK:** (RSB-12R units only)

This standard 1/4" mono jack is used to provide a direct input to the Left HUSH circuit for the RSB-18R. This HUSH is recommended to be used in conjunction with the right HUSH, just before the final outputs to provide maximum noise reduction for your system. For the RSB-12R, this jack provides Left final output. It is fed straight through to the front panel final out jacks. For both units, this jack is automatically fed from the Loop Out Jack of Stereo Loop 11 (left) internally, requiring no need for external wiring or patching, unless a different configuration is desired. The insertion of a plug into the jack to change the configuration will defeat the automatic internal path.

(11) . . . **RIGHT HUSH IN JACK:** (RSB-18R units only)

. . . **RIGHT OUTPUT JACK:** (RSB-12R units only)

This standard 1/4" mono jack is used to provide a direct input to the Right HUSH circuit for the RSB-18R. This HUSH is recommended to be used in conjunction with the left HUSH, just before the final outputs to provide maximum noise reduction for your system. For the RSB-12R, this jack provides Right final output. It is fed straight through to the front panel final out jacks. For both units, this jack is automatically fed from the Loop Out Jack of Stereo Loop 11 (right) internally, requiring no need for external wiring or patching, unless a different configuration is desired. The insertion of a plug into the jack to change the configuration will defeat the automatic internal path.

(12) . . . **C1/C2 JACK:** standard 1/4" stereo jack

The control jacks are directly connected to relay contacts. This allows these jacks to be used to control outboard devices which have footswitchable functions. Control 1/2 jack is set up to either accept a stereo or mono plug. When using a mono plug, this jack will provide function to Control 1. When using a stereo plug, this jack will provide function to both Control 1 and Control 2, as long as there is nothing plugged into the Control 2 jack. If there is something plugged into the Control 2 jack, it will take priority and the Control 1/2 jack will once again only provide function to Control 1. The Control jacks are isolated from the rest of the unit to prevent the formation of ground loops.

(13). . . **C2 JACK:** standard 1/4" mono jack

Control 2 jack is set up to accept a mono plug. When using a mono plug, this jack will provide function to Control 2. If there is nothing plugged into this jack, the Control 1 / 2 jack can be set up to provide function to both Control 1 and Control 2. The Control jacks are isolated from the rest of the unit to prevent the formation of ground loops.

(14). . . **C3/C4 JACK:**

The Control jacks are directly connected to relay contacts. This allows these jacks to be used to control outboard devices which have footswitchable functions. Control 3 / 4 jack is set up to either accept a stereo or mono plug. When using a mono plug, this jack will provide function to Control 3. When using a stereo plug, this jack will provide function to both Control 3 and Control 4, as long as there is nothing plugged into the Control 4 jack. If there is something plugged into the Control 4 jack, it will take priority and the Control 3 / 4 jack will once again only provide function to Control 3. The Control jacks are isolated from the rest of the unit to prevent the formation of ground loops.

(15). . . **C4 JACK:**

Control 4 jack is set up to accept a mono plug. When using a mono plug, this jack will provide function to Control 4. If there is nothing plugged into this jack, the Control 3 / 4 jack can be set up to provide function to both Control 3 and Control 4. The Control jacks are isolated from the rest of the unit to prevent the formation of ground loops.

(16). . . **MIDI OUT CONNECTOR:** standard MIDI 5 pin din connector

The MIDI Out Connector must be connected to the MIDI In Connector of a receiving MIDI device via a standard MIDI cable, in order for the Switching System to be able to send a command to another MIDI device to execute.

(17). . . **MIDI IN CONNECTOR:** standard MIDI 5 pin din connector

The MIDI In Connector must be connected to the MIDI Out Connector of a transmitting MIDI device via a standard MIDI cable, or to the MIDI THRU Connector of the preceding device in a chain of MIDI devices, in order for the Switching System to respond to MIDI commands originating from these devices.

(18). . . **FUSE:**

Externally accessible 1/2 amp fuse.

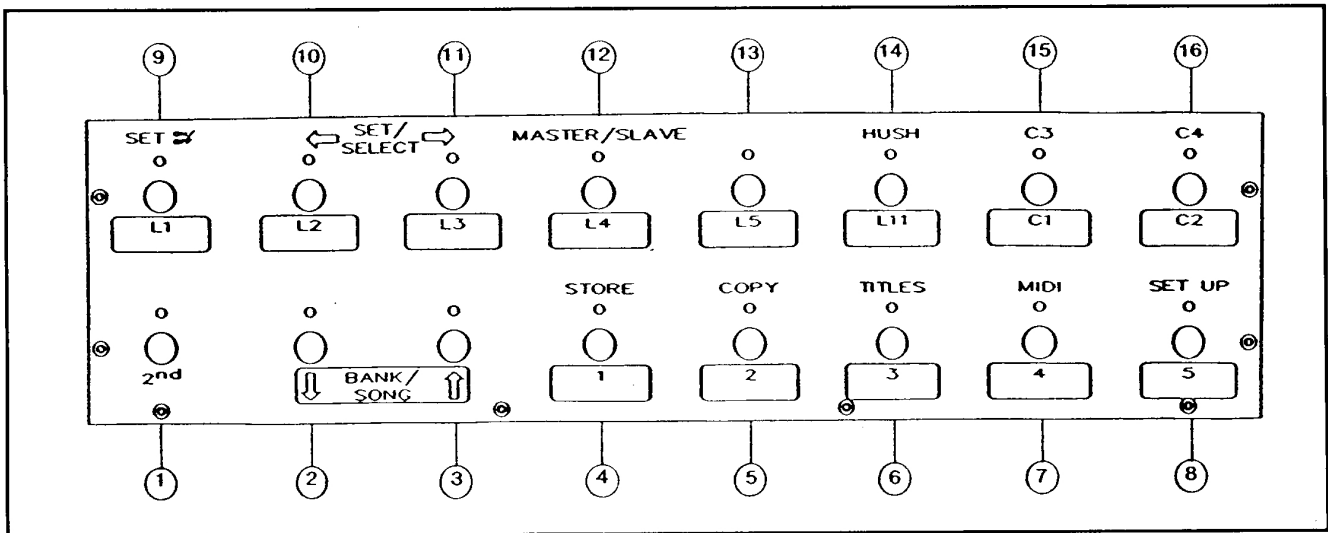
(19). . . **AC POWER CORD:**

NOTE: VERIFY YOUR AC WALL OUTLET'S VOLTAGE RATING AGREES WITH THAT OF THE UNIT.

This cord is provided to connect the unit to your AC wall outlet. **DO NOT RUN THIS UNIT FROM CAR BATTERIES OR ANY OTHER EXTERNAL POWER SOURCE.**

RSB-18F AND RSB-12F FOOTSWITCH DESCRIPTION

BOTTOM PANEL



(1) . . . 2ND SWITCH:

This switch selects between the primary and secondary function of every other switch on the footswitch unit. The primary function of all the other switches corresponds to the label below the switch, while the secondary function corresponds to the label above the switch. When this switch is pressed, the LED above it lights, indicating the secondary functions are available. When the switch is pressed again, the LED turns off, indicating the primary functions are available.

(2) & (3) . . . DOWN ARROW AND UP ARROW (BANK/SONG) SWITCHES:

The function of these switches are to decrement and increment an item or quantity. When in bank mode, they decrement and increment the bank number. When in set mode, they decrement and increment the song number or set entry number. When in title edit, they alter the current character. When in MIDI edit, they decrement or increment the value of the various MIDI parameters. When in MASTER/SLAVE/NORMAL select, they alternate between the 3 selections.

If pressed and held down, the item will be repetitively decremented or incremented until either the switch is released, or the minimum or maximum limit for the particular item is reached. Some items, however, will "wrap around" from their minimum to their maximum value, or vice versa. When in some of the edit modes, the LEDs above these switches will light, reminding that something will happen if these switches are pressed.

(4) . . . 1 \ STORE SWITCH:

The primary function of this switch is to recall bank-preset or song-preset number 1, dependant upon whether you are in bank mode or set mode. The secondary function is to store modified data during an edit operation.

(5) . . . 2 \ COPY SWITCH:

The primary function of this switch is to recall bank-preset or song-preset number 2. The secondary function is to enter or exit the copy function.

(6) . . **3 \ TITLES SWITCH:**

The primary function of this switch is to recall bank-preset or song-preset number 3. The secondary function is to enter or exit the title edit function.

(7) . . **4 \ MIDI SWITCH:**

The primary function of this switch is to recall bank-preset or song-preset number 4. The secondary function is to enter or exit the MIDI edit function.

(8) . . **5 \ SETUP SWITCH:**

The primary function of this switch is to recall bank-preset or song-preset number 5. The secondary function is to enter or exit the SETUP function.

(9) . . **L1 \ SET ON/OFF SWITCH:**

The primary function of this switch is to turn on (insert into the audio path, LED lit) or turn off (bypass, LED off) Loop 1. This will also be accompanied by possible MIDI program change and controller change transmissions, if the unit is so programmed. The secondary function of this switch is to turn on or off the set mode.

(10) & (11) . . **L2 \ LEFT ARROW & L3 \ RIGHT ARROW <SET/SELECT> SWITCHES:**

The primary function of these switches is to turn on or off Loops 2 and 3 and initiate the corresponding MIDI transmissions. The secondary function of these switches is to select the set number when set mode is on, to select the title character for modification in the title edit function, and select the item for modification in the MIDI edit function.

(12) . . **L4 \ MASTER/SLAVE SWITCH:**

The primary function of this switch is to turn on and off Loop 4 and initiate corresponding MIDI program and controller changes, if programmed. The secondary function is to enter and exit the MASTER/SLAVE/NORMAL select function.

(13) . . **L5 SWITCH:**

The primary function of this switch is to turn on and off Loop 5 and initiate corresponding MIDI program and controller changes, if programmed. There is no secondary function for this switch.

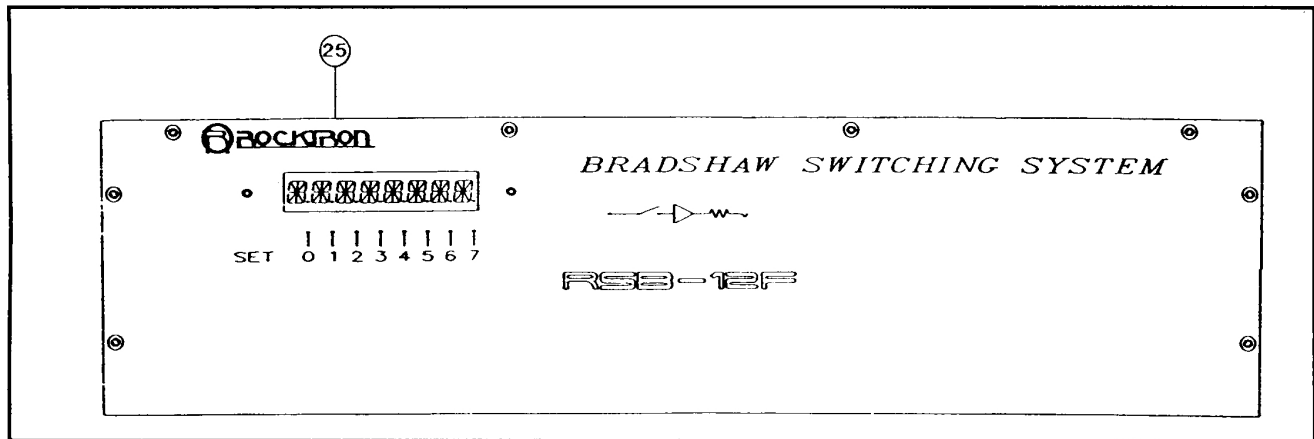
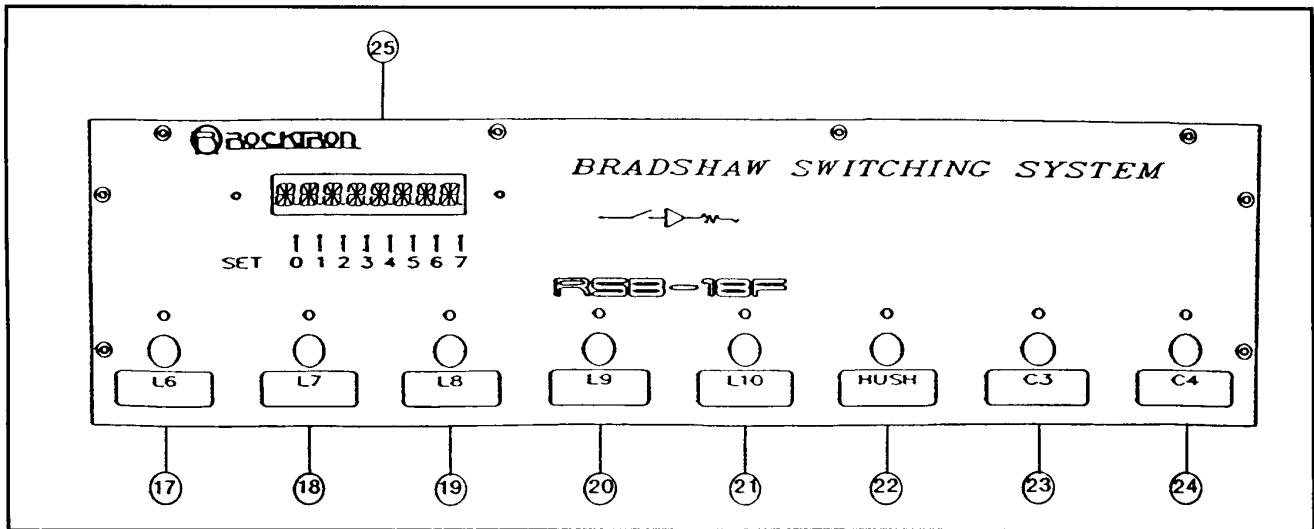
(14) . . **L11 \ HUSH SWITCH:**

The primary function is to turn on and off both the left and right sides of Loop 11, and initiate related MIDI controller and program changes. The secondary function is turn on or off (bypass) the programmable HUSH single ended noise reduction circuit.

(15) & (16) . . **C1 \ C3 & C2 \ C4 SWITCHES:**

The primary and secondary functions of these switches is to turn on and off the control functions C1 through C4, and initiate corresponding MIDI program and controller change transmissions, if so programmed.

TOP PANEL



NOTE: Switches 17 to 24 and their corresponding LEDs are not present on the RSB-12F.

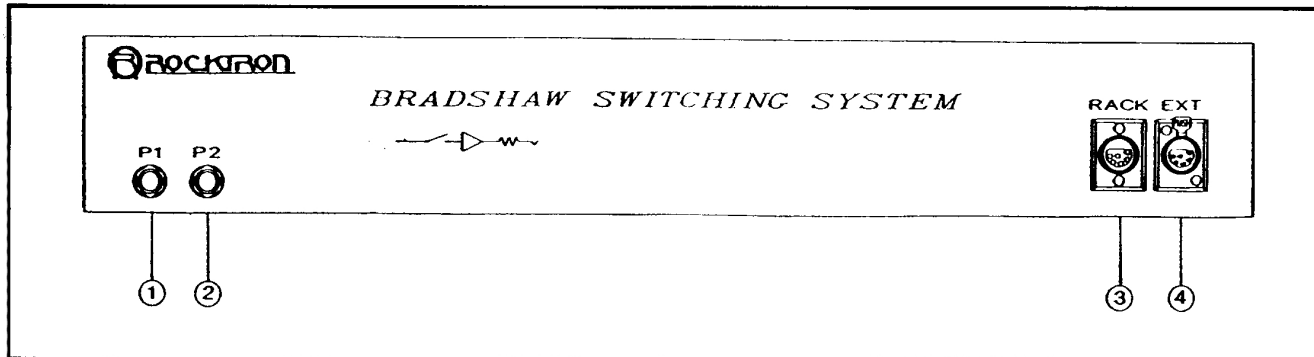
(17) through (24)... **L6, L7, L8, L9, L10, HUSH, C3 & C4 SWITCHES:**

The primary function of these switches are to turn on and off respectively Loops 6, 7, 8, 9, 10, the programmable HUSH, and controls C3 and C4, and initiate the corresponding MIDI program and controller change transmissions, if programmed. The exception to this is the HUSH switch, for which there is no capability to program a corresponding MIDI command. There is no secondary function for these switches.

(25)... **DISPLAY:**

The Display consists of 8 alphanumeric characters of 14 segments each. It is used to display user-programmed sound and song titles, as well as programmed MIDI data and system status and messages. The display also contains 8 decimal points which are used to indicate if set mode is activated and which set number is active.

BACK PANEL



(1) . . **P1 JACK:** standard 1/4" stereo

This jack provides connection for an external expression pedal. Tip=wire to pedal input; Ring=wire to pedal output; Sleeve=ground. The tip of this jack is wired internally to +5V through a 200 Ohm resistor, so that external short circuits will not damage the unit. Maximum resistance of the expression pedal is not critical.

(2) . . **P2 JACK:** standard 1/4" stereo

This jack provides connection for an external expression pedal. Tip=wire to pedal input; Ring=wire to pedal output; Sleeve=ground.

(3) . . **RACK AXR CONNECTOR:**

This 6-pin AXR connector takes a cord to provide power as well as information lines between the rack unit and the footswitch.

CAUTION: DO NOT PLUG IN AXRS WITH THE RACK UNIT POWERED UP.

(4) . . **EXT AXR CONNECTOR:**

This 6-pin AXR connector takes a cord to provide power as well as information lines between additional footswitches. Up to 3 footswitches can be used in a system, with special, heavy gauge cables. Two footswitches may be used with the standard cables.

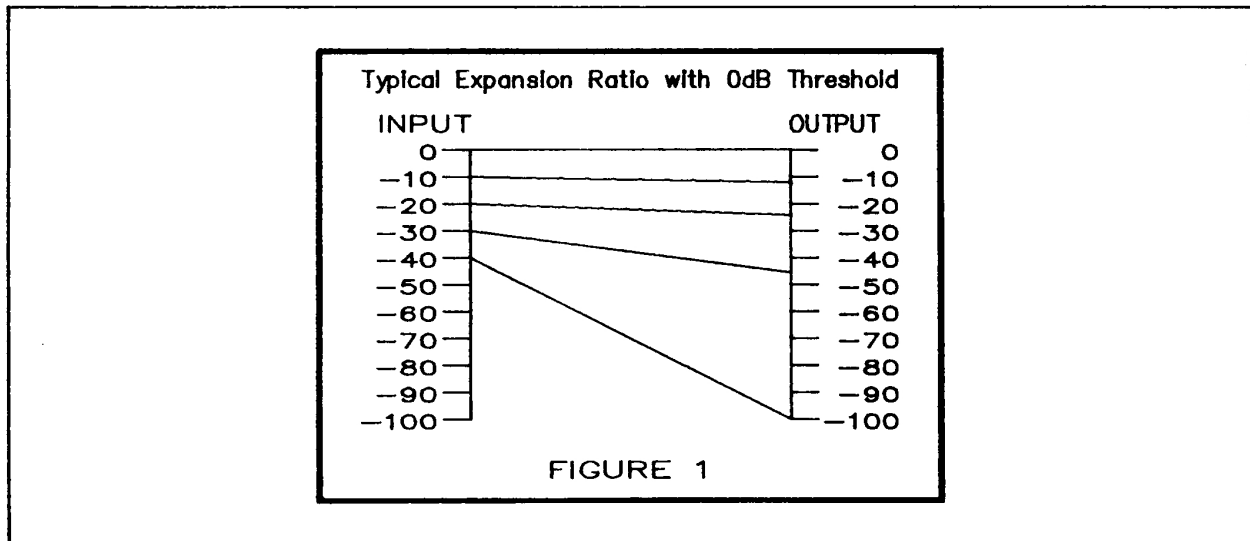
CAUTION: DO NOT PLUG IN AXR'S WITH THE RACK UNIT POWERED UP.

The Switching System footswitches each use a 3-volt lithium battery which maintains power for the program storage while the Switching System is unplugged or turned off from an AC supply. Expected battery life is approximately 10 years. Should replacement be necessary, contact your Rocktron Dealer.

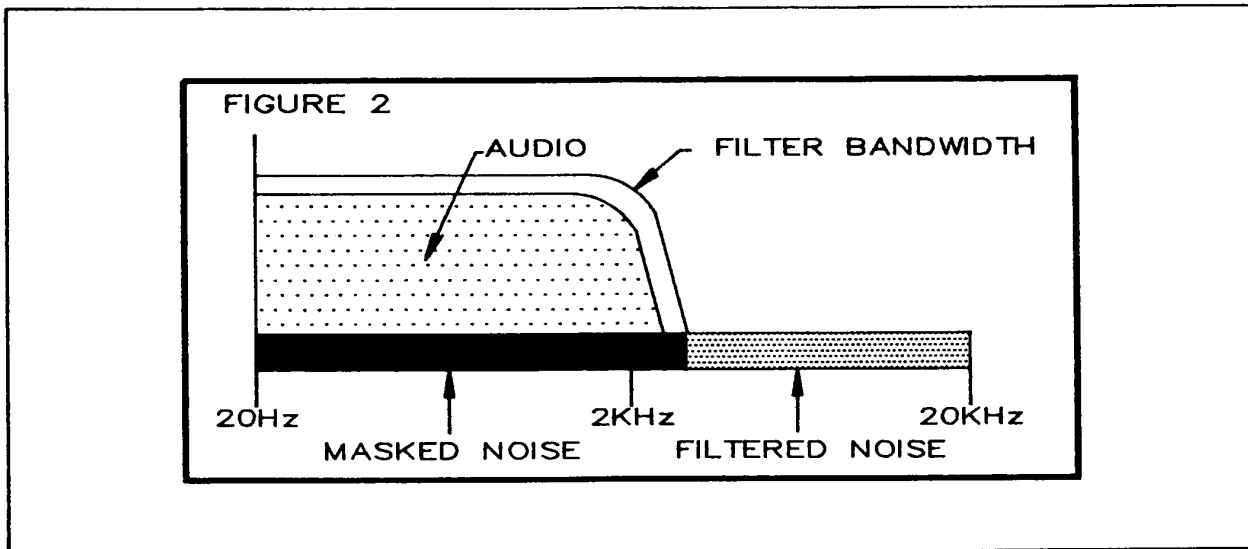
HUSH SECTION

Both the RSB-18R and the RSB-12R are equipped with the Programmable HUSH to provide additional noise reduction for optimal noise free operation. The Programmable HUSH threshold can be set between -70dB to 0dB, and it can be patched anywhere in the system where it is needed. The RSB-18R units also have a left and right HUSH that are normalised to follow the stereo loop, right before the system's final outputs. The HUSH is Rocktron's own patented single-ended noise reduction system. The HUSH circuit is comprised of two parts: the expander and the dynamically controlled low pass filter.

The expander operates like an electronic volume control. The design utilizes a voltage controlled amplifier (VCA) circuit which can control the gain between the input and output from unity to 30, 40 or even 50dB of gain reduction. When the input signal is above the user pre-set threshold point, the VCA circuit is at unity gain. This means that the amplitude of the output signal will be equal to the input signal. As the input signal amplitude drops below the user pre-set threshold point, downward expansion begins. At this point, the VCA operates like an electronic volume control and gradually begins to decrease the output signal level relative to the input signal. For example, if the input signal were to drop below the threshold point by 10dB, the output would drop approximately 12dB. As the input signal drops further below the threshold point, downward expansion increases exponentially. For example, if the input signal dropped 20dB below the threshold point, the output level would drop by approximately 30dB. A drop in the input level by 30dB would cause the output to drop by approximately 60dB, i.e. 30dB of gain reduction. In the absence of any input signal, the expander circuit will reduce the gain so that the noise floor becomes inaudible. See Figure 1.



The dynamically controlled low pass filter operates as follows. In the absence of any audio signal, the dynamic filter will close down to the factory pre-set cut-off point of 800Hz. This means the filter is only allowing frequencies of 800Hz and below to pass through. If an input signal had a bandwidth of from 20Hz to 2KHz, the filter would open far enough to pass up to the 2KHz frequency and its harmonics, while reducing any noise present from approximately 4KHz to 20KHz. If a broad band signal, with frequency components up to 20KHz appears at the input, the dynamic filter would open to its full extreme allowing the bandwidth to open all the way to 40KHz. In simple terms, what this means is that if a signal is present at the input which is primarily bass components, the dynamic filter will reduce any mid or high band noise. However, if the input signal has high frequency components present, the dynamic filter will open to its full extreme to pass the signal and eliminate the possibility of a loss of high end frequency response. See Figure 2.



These two processes of downward expansion and dynamic filtering work in unison to produce the highly proficient HUSH noise reduction system.

SETTING THE HUSH

Typically, the HUSH should be set between -50dB and -60dB when using relatively clean tones. For distortion tones, set the HUSH between -50dB and -20dB. The extreme end settings should only be used in very extreme situations. (i.e.: When using very noisy distortion tones, set the HUSH threshold to more than -20dB, (i.e. -10dB). When using very clean tones, set the HUSH threshold to less than -60dB, (i.e. -70dB).

PATCHING DEVICES INTO THE LOOPS

There are several ways to arrange devices for signal switching in each individual Loop. Three ways to patch devices into the loops are as follows: 1) Device In/Bypass Configuration, 2) Device Mute Configuration, and 3) Device A/B Configuration.

NOTE: When patching a device in a loop, it may be necessary to adjust the Mix Level control for that Loop. If a Loop Mix Level control is turned down, you may get little or no sound from the device in that loop, or if a Loop Mix Level control is turned up, you may get up to a 5.5dB of boost from the device in that loop.

The internal normalised configuration is only changed when you insert a cable, patchcord, etc., into the Loop input or Loop Return jacks. Normalising is unaffected by plugging into the Loop outputs or Loop sent jacks.

Do not plug the output from a power amplifier directly into any of the inputs on the switching system! Doing so may result in damage to the unit. Use a power load device such as the Rocktron/Holdsworth Juice Extractor to interface between a power amp and the line level inputs of this unit.

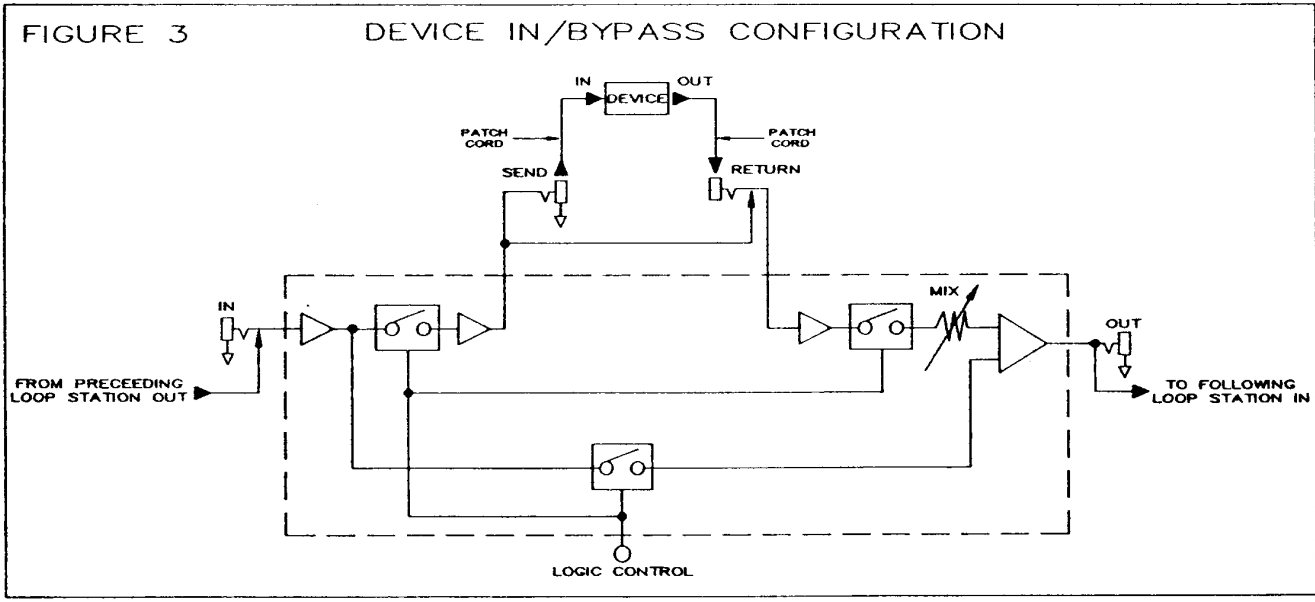
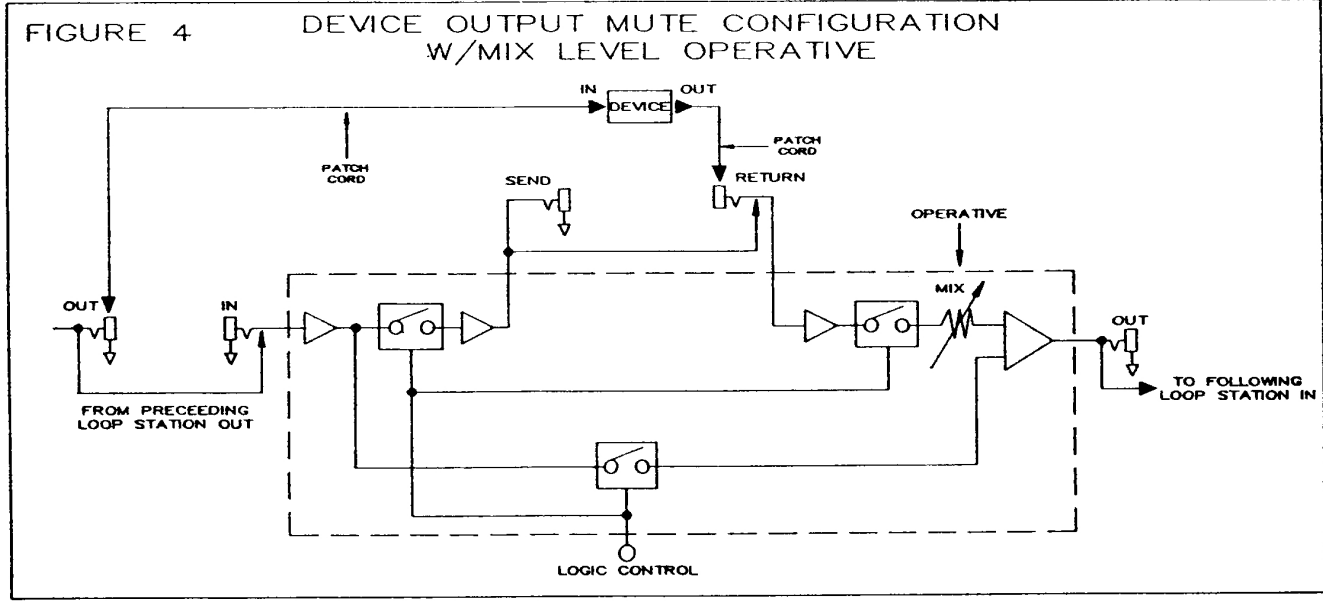
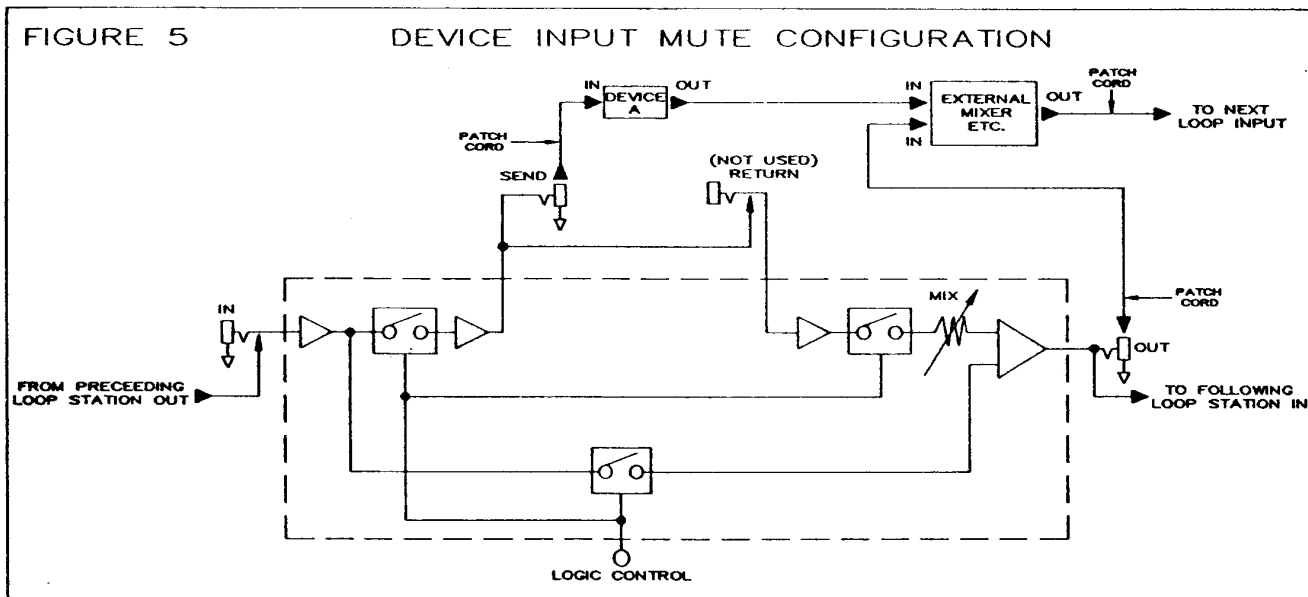
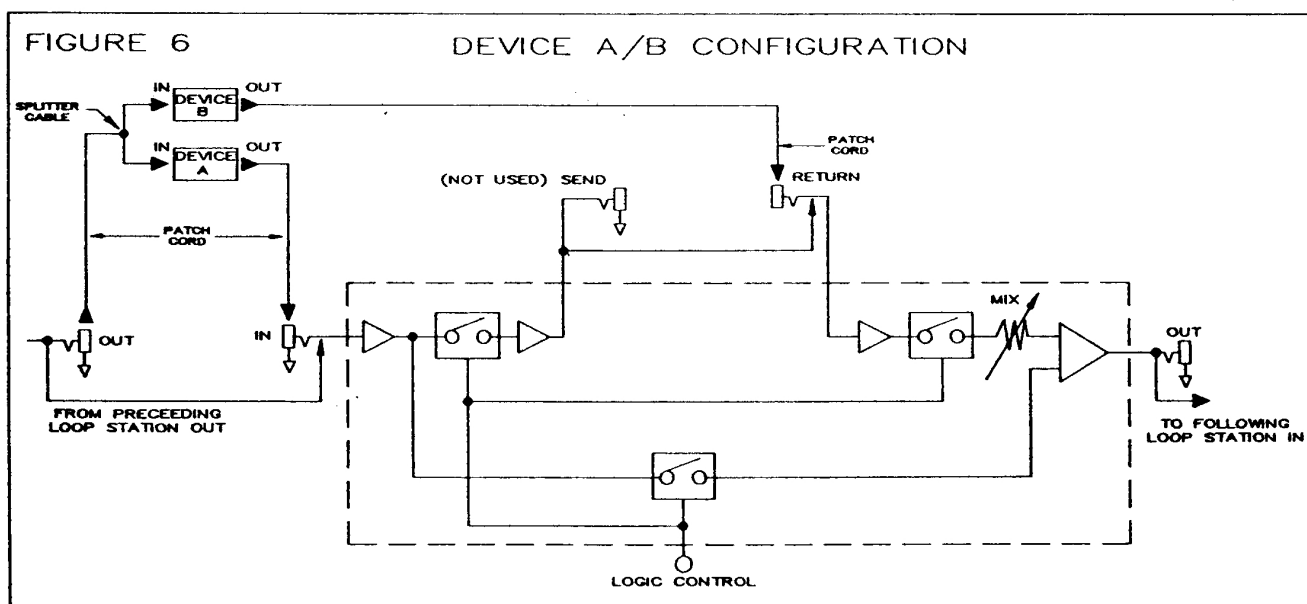


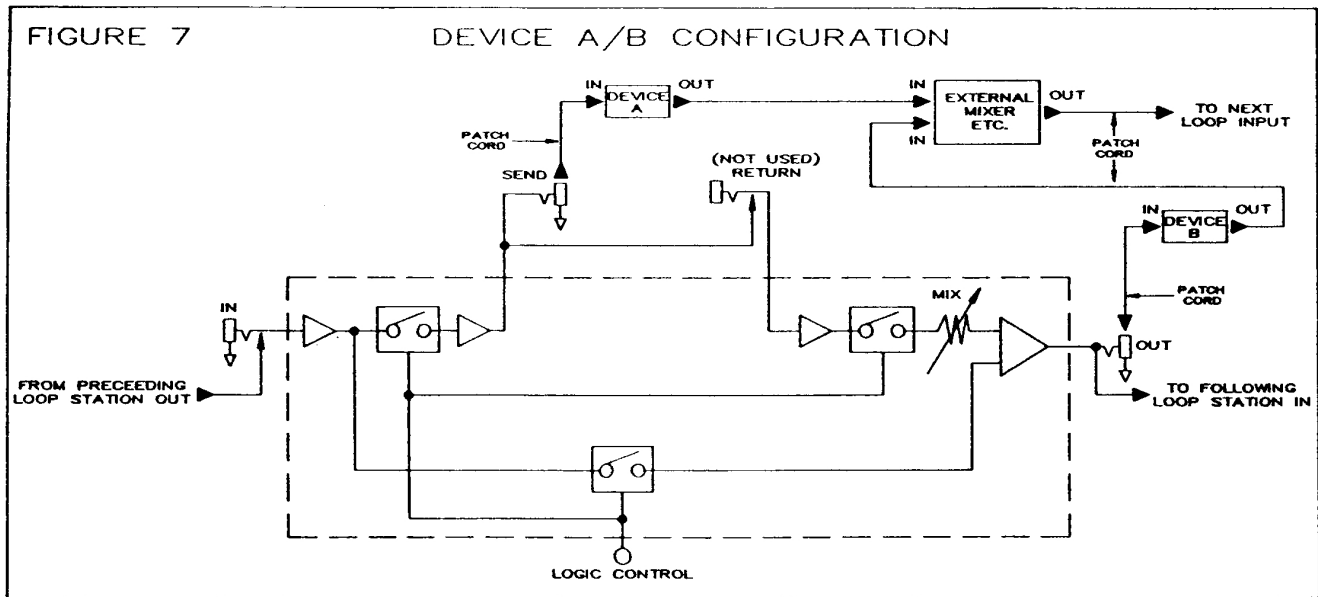
Figure 3 shows the Device In/Bypass Configuration, in which the device is patched by connecting the Loop Send jack to the input of the device and the Loop Return jack to the output of the device. In this configuration, the device is IN when the Loop is IN (LED on), and the device is BYPASSED when the Loop is BYPASSED or out (LED off). This is the most common loop configuration and it can be patched manually into some custom system configuration, or it can be left in it's internal default system configuration where it is placed by it's numeric order, and switched in either parallel or series with the loop before it.





Figures 4 and 5 show the two different Device Mute Configurations. Figure 4 shows a Device Output Mute Configuration with the Mix Level control operative. In this figure, the device is patched into the audio path by connecting the Loop Out jack of the previous loop to the input of the device, and by patching the output of the device to the Loop Return jack. Figure 5 shows a Device Input Mute Configuration with the Mix Level control inoperative. In this figure, the device is patched into the audio path by connecting the Loop Send jack to the input of the device. The Device Output and the Loop Output jack are both patched to mix inputs of an external mixer, etc. Neither the Loop Return jack, or the Loop In jack is used. The mix output of an external mixer, etc. must then be manually patched to the input of the next stage (whether it is a loop, or a device) for the continuation of the audio path.





Figures 6 and 7 show two different ways of setting up the Device A/B Configuration. One example of the Device A/B Configuration is shown in Figure 6. Devices A and B are patched before the loop by connecting the Loop Out jack of the previous loop to the input of Device A and B. (Use of a splitter is necessary to be able to patch to the input of both Device A and B.) The Loop In jack is patched to the output of Device A. Device B is patched by the connection of it's output to the Loop Return jack. The Loop Send jack is not used. In this configuration, Device A is IN when the Loop is IN, and Device B is BYPASSED (LED on). Device B is IN when the Loop is OUT, and Device A is BYPASSED (LED off). In both cases, the outputs from the A and B devices must be patched to an external mixer, and then the output of the external mixer must be patched to the input of the next stage (whether it is a loop, or a device) for the continuation of the audio path. Another A/B Configuration is shown in Figure 7, where device A is patched by connecting the Loop Send jack to the input of Device A. It is necessary to insert a jack plug in the Loop Return jack in order to break the internal normalling connection. Device B is patched by connecting the Loop Out jack to the input of Device B. In this configuration, Device A is IN when the Loop is IN, and Device B is BYPASSED (LED on). Device B is IN when the Loop is OUT, and Device A is BYPASSED (LED off).

Besides the ability of arranging devices in individual loops for different signal switching, each loop also offers the ability to be individually configured in either Series connection with the previous loop, or in Parallel connection with the previous loop. (The switch for this function is located on the front panel of the rack unit. Loops 2-10 have this ability.)

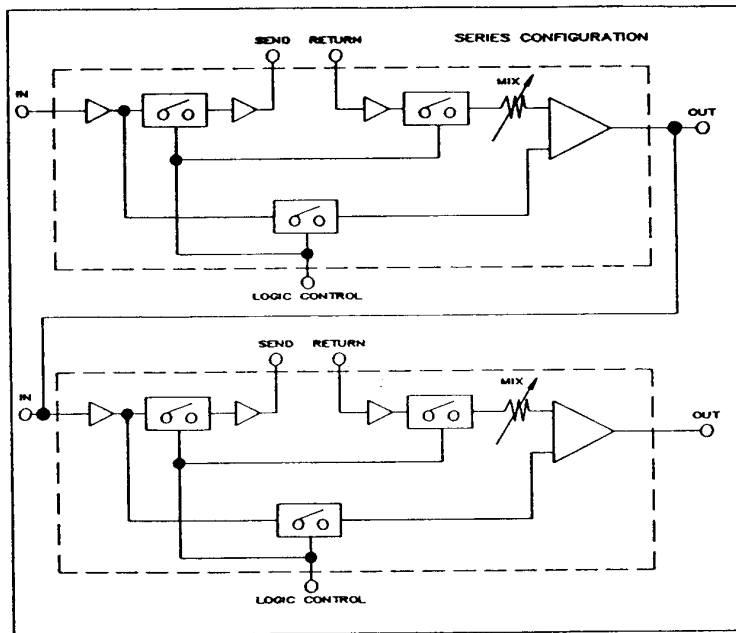


FIGURE 8

Figure 8 shows two loops switched in the Series configuration. The input of the series loop configuration is the first loop numerically that is selected in series. The output jack of that loop will feed the input of the next loop and so on. The last loop numerically that was selected for series loop configuration will have the output signal showing up at it's output jack.

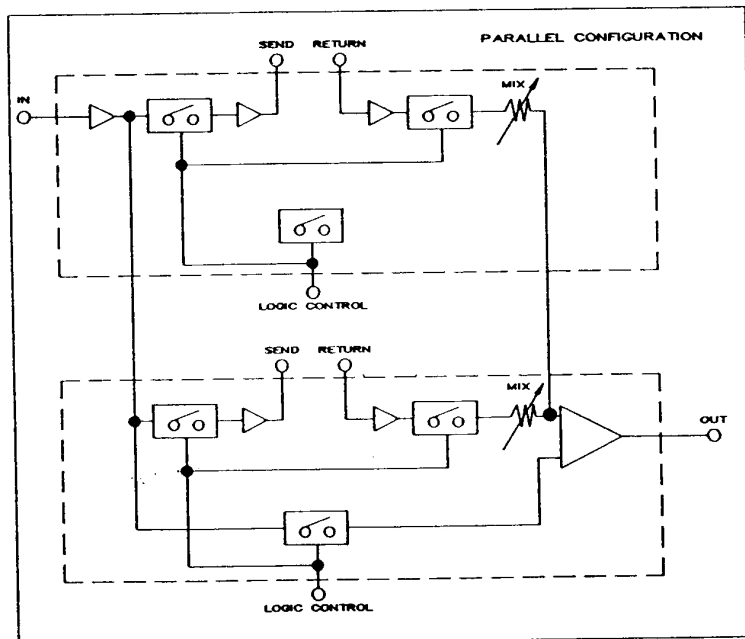


FIGURE 9

Figure 9 shows two loops switched in the Parallel configuration. When in parallel configuration, the signal path can be selected for any one loop, or any combination of loops, or all loops, or no loops (direct signal). The input of the parallel loop configuration is the first loop numerically that is in parallel. The buffer of that loop will feed all the other loops that have been selected for parallel configuration. The last loop numerically that was selected for parallel configuration will have the output signal showing up at it's output jack. Set up the parallel configuration when you want two devices that can be mixed at different levels, or use the parallel configuration to be able to select two separate inputs, keeping the input signal path short.

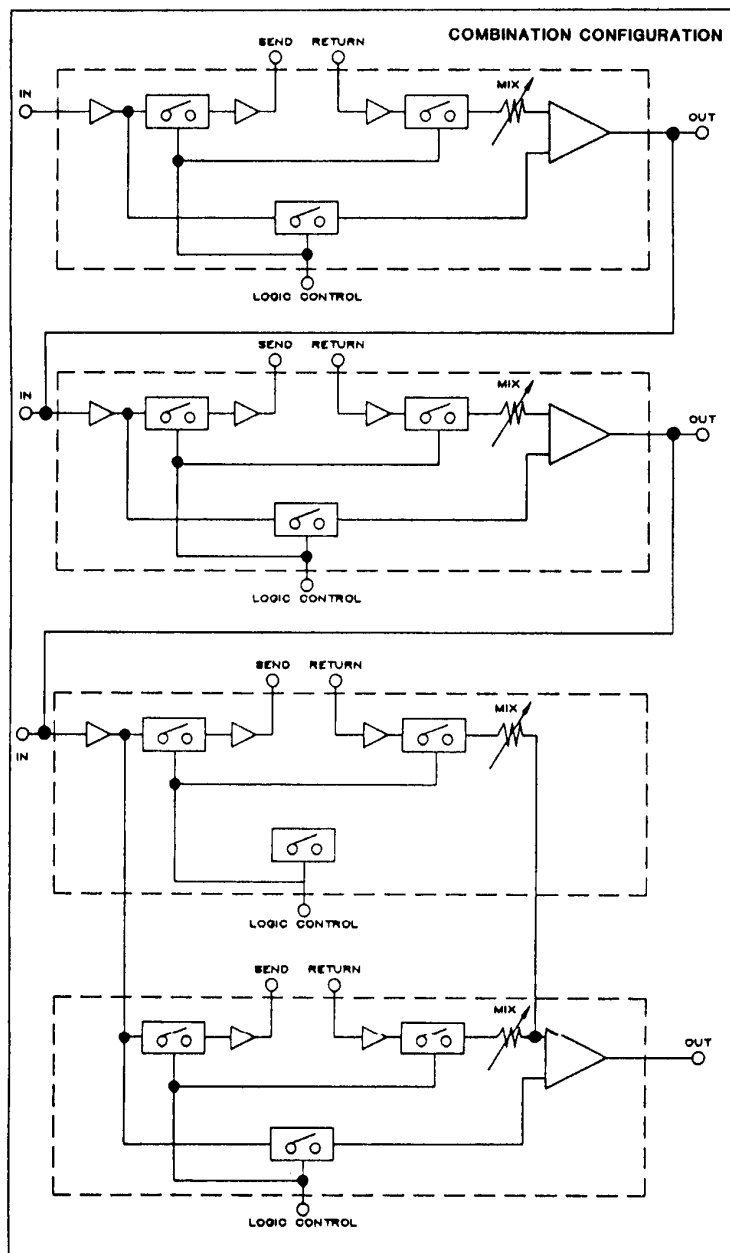
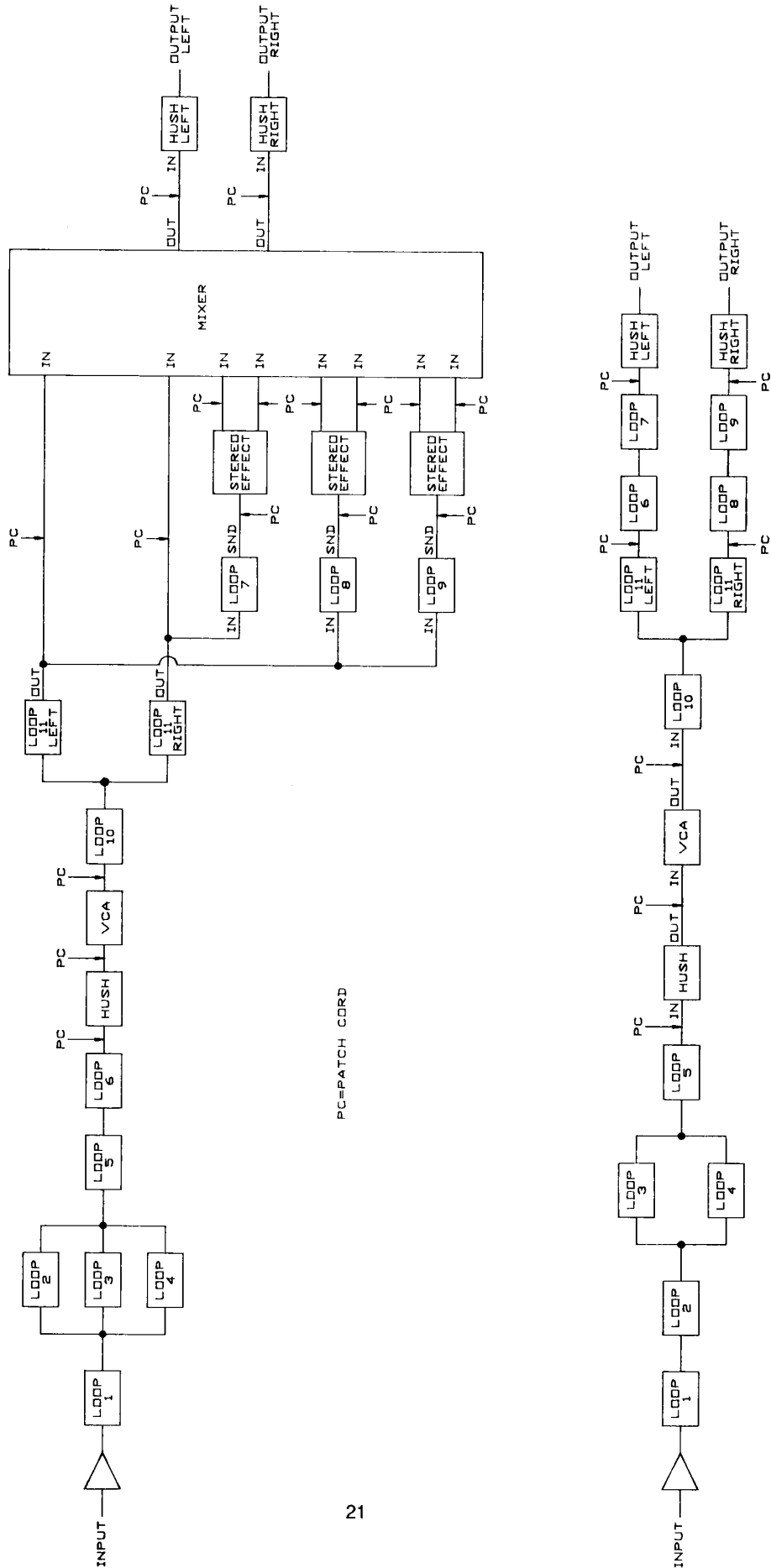


FIGURE 10

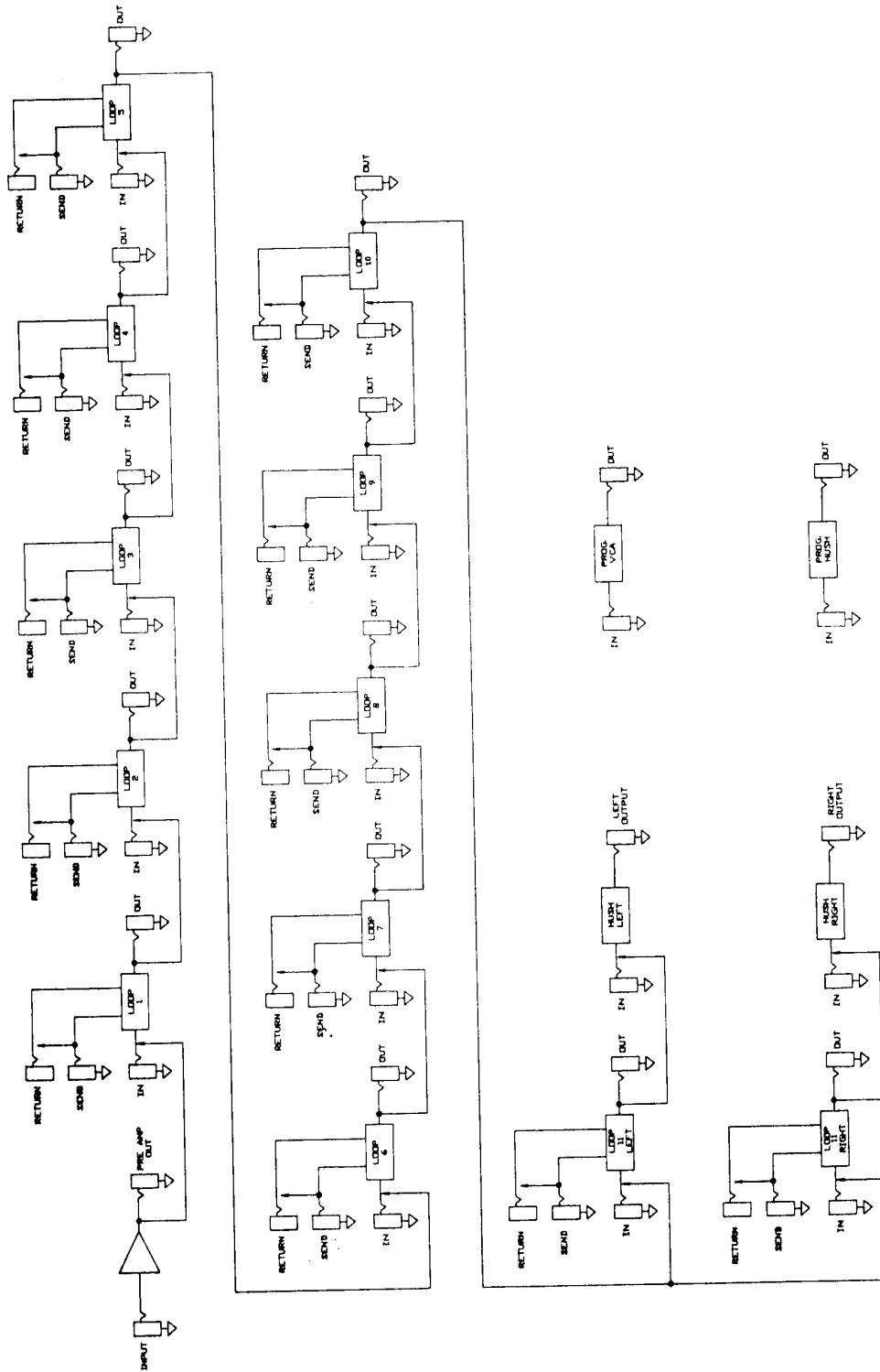
Figure 10 shows a loop diagram in a combination configuration, with loops in both series and parallel in the same system configuration. The possibilities are countless for system configurations.

COMMON SYSTEM CONFIGURATIONS



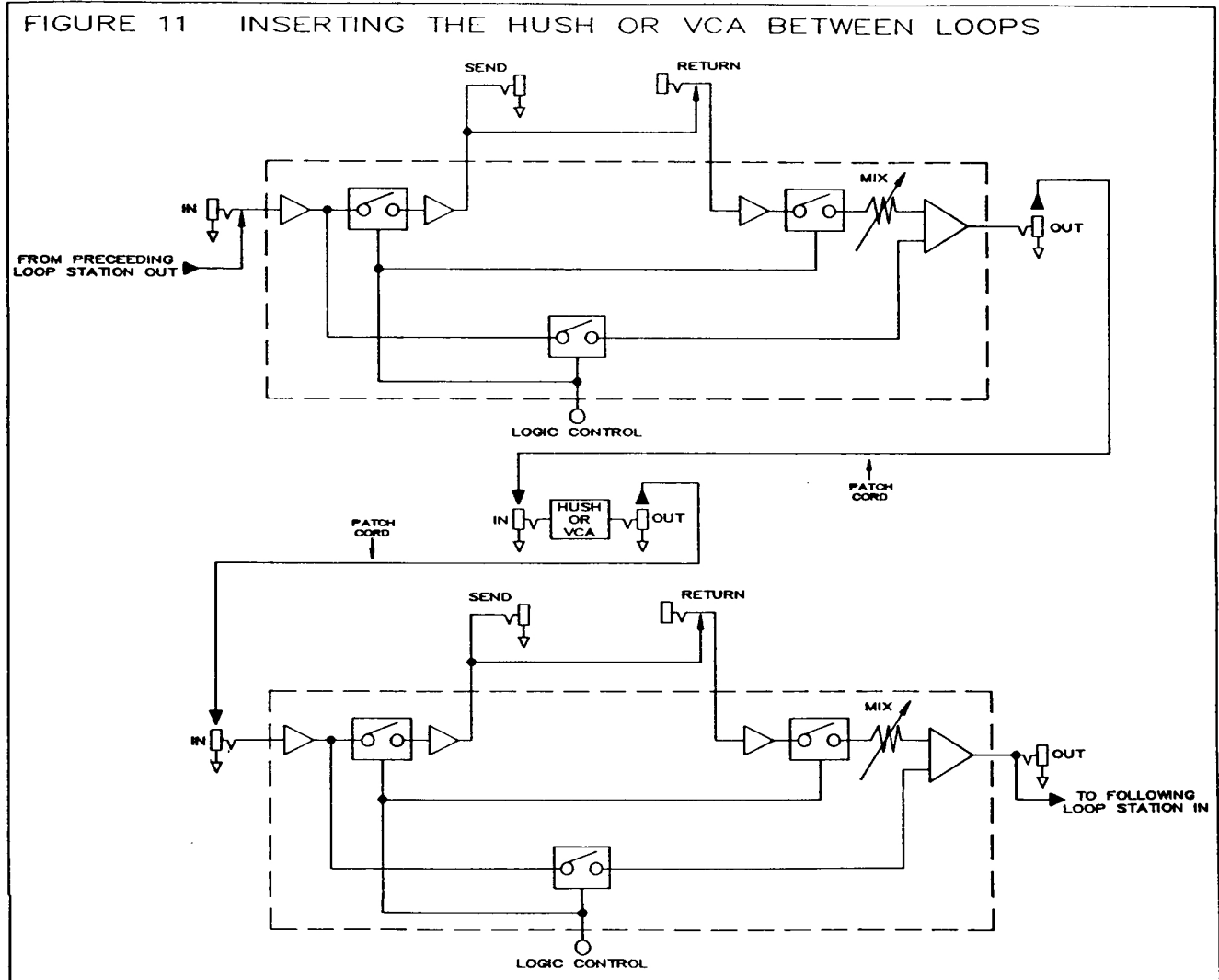
PC=PATCH CORD

SWITCHING SYSTEM AUDIO BLOCK DIAGRAM
 (SHOWN WITH ALL LOOPS IN SERIES CONFIGURATION)



The PRE OUT is simply a buffer to the loops, The entire system allows for a high impedance instrument (i.e. a guitar), to be able to drive the loops. The level of the loops are based on the Loop Mix Level control on the rack front panel. This control is located in the loop circuit between the Loop Return jack and the Loop Output jack. All the loop inputs have an input impedance of 500KHz. (The loop inputs include the Loop Input jacks and the Loop Return jacks.)

The Programmable HUSH and the Programmable VCA must be externally patched in between loops, as shown in Figure 11.



In some cases it may be desirable NOT to use the direct signal of an external device. Stereo Loop 11 provides an extremely clean signal when the Direct switch is pushed in (ON). This allows you to mix the effect signal with the direct signal when using such devices as reverbs, echoes, etc.

INTRODUCTION TO MIDI

MIDI stands for Musical Instrument Digital Interface and was established as a specification which would make it possible to exchange information (program changes, expression control, etc.) between different musical equipment. MIDI makes it possible for a user of MIDI compatible equipment to expand a music system and to change system configurations to meet changing requirements. Some MIDI devices have the ability to originate and transmit MIDI commands (a MIDI transmitter). Other devices may only be able to receive and act on MIDI commands (a MIDI receiver). Some devices are able to do both. The footswitch of the Rocktron/Bradshaw system is able to both originate and receive MIDI commands. The rack unit of the system is only able to receive, retransmit, and act on MIDI commands. It does not originate any commands of its own.

Although the footswitch units send and receive MIDI data, they are not equipped with standard MIDI connectors. If they were, 3 cables would be needed to connect between the units: one for power, one for MIDI In, and one for MIDI Out. Instead, a single 6-conductor shielded cable with locking connectors is used for convenience and reliability. The rack unit provides an interface between this special cable and standard MIDI cables through the standard (5-pin DIN) MIDI In and Out connectors on its rear panel.

MIDI data originating in and transmitted from the footswitch is simultaneously received by the internal processor in the rack unit, and re-transmitted out the MIDI Out jack of the rack unit. Thus, any unit connected to this MIDI Out jack will "see" all MIDI commands transmitted by the footswitch(es), including messages between multiple footswitches, from the master footswitch to the rack unit, and from the master footswitch to other external MIDI devices.

MIDI data originating from external devices and input to the MIDI In jack on the rear of the rack unit will simultaneously be received by the rack unit and all footswitches connected to it.

There are only a specific set of MIDI commands which the rack unit and footswitch unit respond to. These are documented in detail in Appendix A.

For the purpose of controlling external devices, the Rocktron/Bradshaw system transmits two types of MIDI commands: program changes and controller changes. Program changes are used to recall a particular processing algorithm and set of parameters in a processing device. Program changes may be transmitted when a BANK, SONG, or PRESET is recalled on the system, or when one of the L1 through L11 or C1 through C4 switches are changed from off to on (LED lit). The desired program change numbers are programmed into the footswitch unit via the MIDI edit function. The program change numbers can range from 1 to 128 (actual digital values transmitted are from 0 to 127) on any of the 16 MIDI channels from 1 to 16. For any preset, up to 16 program change commands can be transmitted (10 for the RSB-12). Also, 'no change' (NC) can be programmed if it is not desired to transmit a program change for a particular preset or switch.

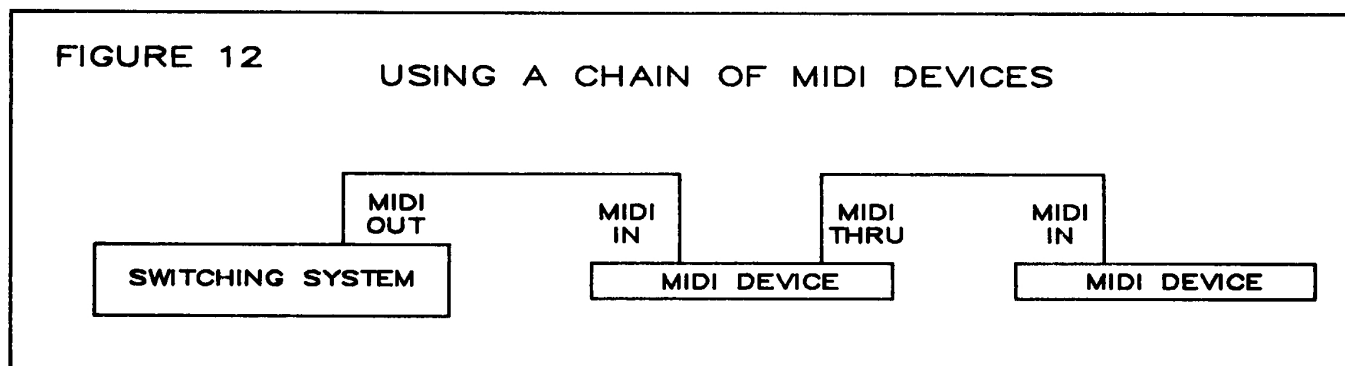
Controller changes are used to alter the value of a particular parameter or group of parameters in a processing device. They may also be used to switch something within a device (such as the external loop on the Rocktron PRO GAP) on or off. Continuous Controller changes may be transmitted when an expression pedal connected to the footswitch unit is varied. The term 'continuous' really means that a range of values from 0 to 127 (integer) can be transmitted to the desired controller number, depending on the position of the expression pedal. The expression pedal contains a potentiometer which varies the resistance between the wiper and ground connections. The value of the potentiometer is not critical (10K to 1M ohms is recommended), and the footswitch software provides for linear, audio, and reverse audio tapers to be used. ON/OFF controller changes may be transmitted when one of the L1 through L11 or C1 through C4 switches are changed. These transmit a value of 0 when switched off, and a value of 127 when switch on. Of course, a no transmission condition can also be programmed. Allowable controller numbers range from 0 to 120 on any of the 16 MIDI channels.

When the user presses a switch on the footswitch unit which results in a MIDI transmission, the following order of events occur. In the 'NORMAL' state, the footswitch transmits a MIDI system exclusive

message to the rack unit, telling it which loops and controls to turn on and off along with VCA and HUSH threshold levels, followed by the list of program changes, followed by the list of controller changes. In the 'MASTER' state, the preceding is followed by a system exclusive message back to the slave footswitches which contains the data to be displayed on their LEDs and displays. In the 'SLAVE' state, the footswitch simply transmits a system exclusive message which contains the number of the switch which was pressed. The master receives this message and then acts as if that same switch on its own front panel were pressed.

CONNECTING EXTERNAL MIDI DEVICES

Multiple external MIDI devices can be controlled by the switching system by connecting the units as shown in Figure 12. The MIDI Thru jack on a unit simply passes on the original MIDI signal which is input to the MIDI In jack of that same unit. The delay between the In and Thru jack should only be on the order of a microsecond, however, there is a limit to the number of devices which can be chained together (series connected) in this fashion. With a multitude of devices, a slight distortion of the MIDI signal can occur, which can cause an error in MIDI signal transmission. Should this problem arise, a MIDI Thru box can be used, which connects to the MIDI Out jack, and has multiple connectors for the multiple devices receiving MIDI. MIDI cables should not exceed 50 feet (15 meters) in length, and for connecting multiple devices within a single rack, short cables of only a foot or two in length are much more desirable.



FOOTSWITCH OPERATION **POWER UP**

Upon power up, the footswitch briefly displays the word RESET, followed by the version number of the software (this document describes V1.0 software). The contents of the display before power down are then recalled. The last used preset is then recalled and the associated MIDI data is transmitted (this does not occur if the footswitch is set to SLAVE). Note that if any of the individual loop or control switches were in an altered state at power down, the altered status will be lost and the status programmed for that particular preset will be used.

SETTING MASTER/SLAVE/NORMAL OPERATION

For single footswitch systems, it is recommended that the footswitch be set to NORMAL. For multiple footswitch systems, one footswitch needs to be set to MASTER and the others set to SLAVE. The factory setting is to NORMAL. If a footswitch does not appear to operate when the switches are pressed, but the display is lit, it is probably because it is set to SLAVE (if this condition occurs with multiple footswitches, it is probably because all of the footswitches are set to SLAVE). To alter the setting, press the 2nd and MASTER/SLAVE switches. The current status will then be displayed. Alter the status by pressing either the UP ARROW or DOWN ARROW switches. When the desired status is displayed, press the MASTER/SLAVE or 2nd switches again. It is not necessary to press STORE. Note that for

footswitches set to SLAVE, this is one of the few instances where the display contents will not be exactly the same as on the MASTER footswitch.

BANK MODE

The basic mode of operation for the system is Bank Mode. Each bank consists of 5 presets. To select a particular preset, press one of the numbered switches 1 through 5. There are 25 banks of 5 presets per bank for a total of 125 presets. Each preset is capable of storing the loop switch status and MIDI program change and controller change data needed in the implementation of a particular sound process. In bank mode, the decimal points in the display are off, except when editing titles or data. Each bank-preset has its own 8 character title. To increment a bank, press the UP ARROW switch. To decrement a bank, press the DOWN ARROW switch. Continued depression of either of these switches will result in repetitive increment or decrement operations. As you change banks, the preset number selected will be recalled immediately. If 2nd function is OFF, the bank-preset titles will be displayed. If 2nd function is ON, the bank number will be displayed. The default titles are B 1 P 1 for bank 1 preset 1, B 2 P 1 for bank 2 preset 1, etc. These titles may be edited according to the users needs.

SET MODE

In the Set Mode, the particular sound process information stored in the bank-presets can be grouped and arranged in any desired order for convenient access and recall during the performance of songs. Each 'Song' can contain 5 presets. If a particular song requires the use of more than 5 presets, more than 1 'Song' within the system memory can be used. Further, the songs can be grouped and arranged in any desired order within sets.

To enter or exit set mode, hit 2nd, SET ON/OFF. One of the decimal points will be lit, indicating which set you are in. The LEFT ARROW and RIGHT ARROW switches alter the set number. Set 0 (zero) is the master song list of 128 songs. Sets 1 to 7 can contain 50 entries each. Each entry is one of the 128 songs from the master song list.

PRESET switches 1 to 5 select the song-preset number. Into each song-preset a bank-preset may have been copied during programming with the copy function. Selecting a song-preset will recall the associated bank-preset, and transmit the MIDI data programmed for the bank-preset. The default bank-presets for each song are Bank 1 Preset 1 through Bank 1 Preset 5.

In set 0, the UP ARROW and DOWN ARROW switches increment and decrement the song number. The song title will be displayed, preset 1 will be selected, and the MIDI data will be transmitted to the rack. The default song titles are SONG 1, SONG 2, etc. These may be edited to any 8 character title desired.

When the 2nd switch is on in set 0, the display will show the song number, bank number, and preset number in the format S###B###, where the first two digits after the B are the bank number and the last digit is the preset number within that bank which has been recalled. Note that this is the bank-preset number, and not the song-preset number.

In sets 1 to 7, the UP ARROW and DOWN ARROW switches increment and decrement the entry number. The title of the song copied into this entry will be displayed, song preset 1 will be selected, and the MIDI data will be transmitted to the rack. For set 1, the default songs are SONG 1 through SONG 50, for set 2 they are SONG 51 through 100, etc. Of course, these may be reprogrammed to any order the user desires.

When the 2nd switch is on in sets 1 through 7, the display will show the entry number and song number associated with that entry in the format E## S###, where the first two digits after the E are the entry number within the current set and the three digits after the S are the song number within the master song list (set 0) which has been copied to this entry.

FOOTSWITCH PROGRAMMING TO PROGRAM LOOP AND CONTROL ON/OFF

Alter the loop (L1 to L11), HUSH, or control (C1 to C4) status by pressing the corresponding switch. When the desired status of all loops is achieved, press 2nd, STORE to store this status for later recall. Failure to press STORE will result in the alterations being lost when a different preset is recalled.

Altering the loops can be done in either bank mode or set mode, but any STOREd alterations will show up in every song which recalls the altered bank-preset. The factory programmed settings are for all loops and controls off in all presets.

TITLE EDIT FUNCTION

Titles for bank-presets or songs can be entered or modified by pressing 2nd, TITLES after the bank-preset or song has been selected. The cursor is a blinking decimal point next to the character to be entered or altered. Move the cursor by using the LEFT ARROW or RIGHT ARROW. Alter the selected character by using the UP ARROW or DOWN ARROW. When you have completed the modifications, store the title by pressing STORE. Exit programming without store by pressing 2nd or TITLES again.

MIDI EDIT FUNCTION

Enter MIDI programming by pressing 2nd, MIDI. There are five lists to program within the MIDI edit function. Each list consists of one or more items. You can select between the items within a list by pressing the LEFT ARROW or RIGHT ARROW switches. You can alter the value of an item by pressing the UP or DOWN ARROW switches. When you have completed the modifications to the items within a list and you desire to save the modified values, press the STORE switch. This will write over the previously stored values in the memory. **FAILURE TO PRESS STORE BEFORE PROCEEDING TO THE NEXT LIST WILL RESULT IN THE LOSS OF THE MODIFIED VALUES.** To proceed to the next list, press MIDI again. When the final list is reached, pressing MIDI once more will result in an exit from the MIDI edit function. The only way to get from one list to a previous list is to exit the MIDI edit function and re-enter it again. The MIDI edit function can also be exited at any point by pressing the 2nd switch.

When you are in the MIDI edit function, most of the other switches will not be operational. An important exception to this is the 2nd row HUSH in/out switch. This switch remains able to switch the programmable HUSH in or out as an aid in setting the HUSH threshold level.

The first list contains the VCA level and HUSH threshold in dB. These values can be programmed differently for every bank-preset. Possible values for the VCA level are from -77dB (full attenuation) to 0dB (no attenuation), and NC (no change), which results in the VCA attenuation level remaining unchanged from its previous setting, whatever that happens to be. When this item is displayed, its value can be altered either with the UP or DOWN ARROW switches, or via an expression pedal plugged into the Pedal 1 jack.

Possible values for the HUSH threshold are from -70dB to 0dB, and NC (no change). Factory programmed values for these two items are NC. Changes in the values of these items during editing are immediately transmitted to the rack unit.

The second list can also be programmed with different values for each bank-preset, and consists of data for MIDI program change transmissions. The contents of the display for each item are shown here, followed by an explanation.

NOTE: The software skips over editing for L6 to L10 on the RSB-12 units (assuming the footswitch type has not been altered in the SETUP function).

- PR CH## : ## is the channel for preset program change (1 to 16).
The factory programmed value for this item is 1.
- PR PC### : ### is the preset program change number (1 to 128). NC means no program change will occur. This program change is always transmitted when the preset is recalled. The factory programmed value for this item is (BANK-1) *5 + PRESET.
- L1 PC### : ### is the program change number transmitted only when LOOP 1 is on. This program change will be transmitted at the occurrence of either of two events. The first is when the preset is first recalled and L1 is programmed on for this preset. The second is after this preset is recalled, any time L1 is switched from off to on by pressing the L1 switch. NC means no program change will be transmitted. The factory programmed value for this and the remaining items in this list is NC.
- L2 PC### : same, except for LOOP 2.
- L3 PC### : " " " " 3.
- L4 PC### : " " " " 4.
- L5 PC### : " " " " 5.
- L11 PC### : " " " " 11.
- C1 PC### : " " " C1.
- C2 PC### : " " " C2.
- L6 PC### : " " " LOOP 6 (6-10 only function on RSB18)
- L7 PC### : " " " " 7.
- L8 PC### : " " " " 8.
- L9 PC### : " " " " 9.
- L10 PC### : " " " " 10.
- C3 PC### : " " " C3.
- C4 PC### : " " " C4.

Modifications of the program change numbers during editing result in the immediate transmission of that program change, to aid the user in the selection of the desired value.

The third list contains MIDI controller numbers and MIDI channels for the expression pedal inputs 1 and 2. These also can be programmed with unique values for each bank-preset. The second list consists of:

- P1 C### : ### is the MIDI controller number that pedal 1 will transmit to. Values are 0 to 120, OFF means no transmission will occur, and VCA means the pedal will control the VCA in the rack unit. If the pedal is altered while this item is selected, the display will show the control value being measured and transmitted in the format P1 Vnnn. The factory programmed value is VCA.
- P1 CH## : ## is the channel for the pedal 1 control changes. If VCA has been selected for the pedal 1 controller, the channel number will be ignored.

- P2 C### : same as for pedal 1, except the factory programmed value is OFF.
- P2 CH## : same as for pedal 1.

Modifications to these values during editing immediately effect the operation of the expression pedals. Also, if the expression pedal setting is altered during the editing of the controller numbers, the value read from the expression pedal will be displayed as 'V###' over the top of the controller number, where ### is a number from 0 to 127. To restore the display of the controller number, press the RIGHT ARROW then the LEFT ARROW switches.

The fourth list contains channel numbers for each loop/control program change and control transmission. NOTE: this list is common to all presets, so modifying the values will change them for all presets. Also, the software skips over editing for L6 to L10 on the RSB-12 units (assuming the footswitch type has not been altered in the SETUP function).

The fourth list consists of:

- L1 CH## : ## is the channel for the LOOP 1 program change.
- L2 CH## : same for LOOP 2.

- C4 CH## : same for control 4.

The factory programmed values for these items are 1 to 11 for L1 to L11 respectively, and 12 to 15 for C1 to C4, respectively. Modifications of these values will have no effect until the new values are stored, the MIDI edit function is exited, and the related switch is pressed which results in transmission of a MIDI program or controller change command.

The fifth list contains controller numbers associated with each L1 to L11 and C1 to C4 switch. NOTE: this list is also common to all presets, so modifying the values will change them for all presets. Allowable controller numbers are 0 to 120, and OFF. Factory programmed values for all of these are OFF. When a preset is recalled or one of the L1 to L11 or C1 to C4 switches is pressed, an ON/OFF controller change will be transmitted to the corresponding programmed controller number from this list on the MIDI channel associated with that switch for list number 4. A controller value of 0 will be sent if the switch is off, and a value of 127 will be sent if the switch is on. This allows these switches to directly switch on or off a function in some external device, such as the external process loop in the Rocktron PROGAP. As with the previous list, modifications to the items in this list will not become effective until the STORE switch is pressed and the MIDI edit function is exited. Also, the L6 to L10 items will be skipped by the software on the RSB-12 models (assuming the footswitch type has not been altered in the SETUP function). NOTE: the MIDI edit function can be entered from the bank and set modes.

Also, any STORED modifications to the MIDI data for a song-preset will actually modify the corresponding bank-preset, so that all other songs which recall this bank-preset will be modified.

COPY FUNCTION

The copy function allows you to copy a bank-preset into another bank-preset, a bank-preset into a song-preset (to construct songs), a song into a song, and a song into a set entry (to construct sets).

To copy one item into another, select the source bank-preset or song, then press 2nd, COPY. A helpful message is scrolled across the display at this time. Pressing any switch at this time will result in the immediate cancellation of this message. Then select the destination bank-preset, song, or set-entry just as you would in the normal manner. To then execute the copy, press 2nd, STORE. The copy function will be exited, and the copied preset will then be recalled. To cancel the copy, press 2nd, COPY.

NOTE: there are important differences in the operation of the footswitch when in the copy function. After the COPY switch is pressed, the lower row of switches revert to their primary functions (2nd, DOWN ARROW, UP ARROW, PRESETS 1 through 5), while the SET ON/OFF and LEFT and RIGHT ARROW switches remain in their secondary functions. This is to aid in the copying of bank-presets into song-presets, etc., by reducing the number of times the 2nd switch has to be pressed. The other switches (L4 through L11, C1 through C4, and HUSH) do not operate when in the copy function.

Here are some examples:

To copy a bank-preset into a song-preset,

1. Select the desired bank-preset (set mode off).
2. Press 2nd, then COPY.
3. Press SET ON/OFF to turn on set mode.
4. If the set 0 decimal point is not lit, select set 0 (master song list) by using the LEFT ARROW switch.
5. Select the destination song by pressing the UP or DOWN ARROW switches.
6. Select the song-preset by pressing a preset switch 1 to 5.
7. Press 2nd, the STORE to complete the copy.

To copy a song into a set 1 - 7 entry,

1. Select the desired song (set=0).
2. Press 2nd, then COPY.
3. Select the destination set by pressing the RIGHT ARROW switch.
4. Select the destination entry by pressing the UP or DOWN ARROW switches.
5. Press 2nd, then STORE to complete the copy.

Here are some other important things to know about the copy function.

When copying one bank-preset into another, the title is copied.

When copying one song into another, the title is not copied.

When copying a bank-preset number into the song-preset, you are simply writing the bank-preset number into the song-preset. When that song-preset is recalled, the bank-preset with that number is recalled.

When copying a song into a set entry, you are simply writing the song number into that entry. When that entry is recalled, the song with that number is then recalled.

NOTE: because operation of the footswitch when within the copy function closely resembles that of non-copy operation, you may be 'lost' in the copy function and not realize it, except for the fact that the L1 through C4 switches and the expression pedals do not function. To check, press the 2nd switch so that the 2nd LED is lit. The COPY LED will also be lit at this time if you are in the COPY function. If so, press the COPY switch to exit.

SETUP FUNCTION

The SETUP function performs initialization of the footswitch and allows you to tailor some of the system characteristics (C1 to C4 ON/OFF or MOMENTARY operation, and expression pedal taper) to your own needs and preferences. It also allows for program transfers between two footswitches or between the footswitch and an external MIDI recorder (sequencer). The SETUP function can only be invoked when the footswitch is in the 'NORMAL' state. When you try to enter it from 'MASTER' or 'SLAVE' state, a message will be displayed stating you must be in 'NORMAL'. One reason for this is that it is probably not desirable to allow slave footswitches to alter some fundamental operational parameters of the system. Rather, for multiple footswitch systems, you must deliberately place the master footswitch into the 'NORMAL' state before proceeding with SETUP alterations.

To enter the SETUP function from the normal state, press the 2nd switch (assuming 2nd is off and you are not still in the COPY, MIDI, or TITLES functions), then press the SETUP switch. First, the following message is scrolled across the display: 'PROGRAM CONTROL FUNCTIONS C1 - C4 FOR ON/OFF OR MOMENTARY ACTION'. Since it takes several seconds to fully display this message, the experienced user may wish to press a switch before the message is complete. This will cause an immediate jump to the following display of the status of C1 as "C1ON/OFF" or 'C1MOMENT'. To toggle between the two possibilities, use the up or down arrow switches. To alter the status of C2 to C4, use the right and left arrow switches. When the status of a control is altered, the new status will immediately be transmitted to the rack unit, which may result in a control that is on being switched off or vice versa. The status of each control will also be transmitted to the rack at power up time or when a footswitch is switched from the 'SLAVE' to the 'NORMAL' state. The status of the controls is not remembered by the rack unit during power down. Also, it is not necessary to press store before proceeding to the next list. The factory settings for the controls are to on/off type action.

If it is not yet clear, the control functions are simply relays which close and open under program control to simulate the operation of simple footswitches in order for the switching system to control footswitchable devices. Simply run a 1/4" phone jack connecting cable from the footswitch jack on the unit to be controlled to one of the C1 to C4 jacks on the back of the RSB-12R or RSB-18R rack unit.

Some manufacturers use on/off type footswitches. These close a contact when they are pressed and released once, and open the contact when pressed and released a second time. To provide this type of action, set the desired control to ON/OFF in SETUP. Also, each control function has a front panel switch which allows selection of normally open (n.o.) or normally closed (n.c.) operation. When set to normally open, the footswitch and rack front panel LED for that control will be off when the contacts are open, and on when the contacts are closed. When set to normally closed, the LEDs will be off when the contact is closed, and on when the contact is open. The reason for providing this control is to allow the unit to be setup so that the switching system LEDs are on when the desired operation within the external unit under control is achieved. For some units, this may result when the contacts are closed, for other units it may require the contacts to be open.

Other devices require a momentary type switch. This type briefly closes the contacts when the switch is pressed, and reopens them when the switch is released. To provide a similar type action from the switching system, set the desired control to MOMENT in SETUP. Note however that the switching system will only close (or open, if set to n.c.) the contacts for about 60 milliseconds, then reopen them, rather than waiting for you to release the switch.

After the type of control action is selected, press the SETUP switch again to proceed to the list for expression pedal taper. The following message will be scrolled across the display: 'PROGRAM EXPRESSION PEDAL TAPER'. Again, pressing a switch before the message is complete will cause an immediate jump to the following display of the status of the P1 taper. The possible values are "P1LINEAR" for linear taper of the expression pedal, "P1 AUDIO" for audio taper, and 'P1 REVAUD' for reverse audio

taper. Select the status by pressing the up or down arrow switches. Alternate between P1 and P2 by pressing the left and right arrow switches. Selecting the audio taper will try to make an audio taper expression pedal act like a linear one, and likewise when reverse audio is selected. Using one of these curves on a linear taper pedal may also yield desirable results. Feel free to experiment. The factory settings for these parameters is LINEAR. Again, you do not need to press STORE before proceeding.

Press the SETUP switch again to proceed to the function for transferring programmed data from this footswitch to a second footswitch or to a MIDI recording device (sequencer) for archival storage. The MIDI recording device must be connected to the system via a standard MIDI cable from the MIDI OUT on the rear of the rack unit to the MIDI IN on the recorder. For footswitch to footswitch transfer, both footswitches must be connected together via a cable from the 'EXT' jack on one to the 'RACK' jack on the other, with the remaining 'RACK' jack on the first footswitch connected to the rack footswitch jack, so that the two footswitches are supplied with power. When entering this part of the function, the following message will be displayed: 'PROGRAM TRANSFER PRESS COPY TO BEGIN TRANSMISSION - OR PRESS SETUP TO CANCEL'. At this time, the MIDI recorder should be placed in the record mode, or the second footswitch should be placed in receive mode. Press COPY to begin the transmission. The entire contents of the programmable data memory will be transmitted in 264 separate blocks. Each block will range in size from 42 bytes to 140 bytes. Within each block, transmission will occur without pause between the bytes. Between each block, a short pause (about 10 milliseconds) will be inserted before transmission resumes. For those who are interested, a block is in the form of a MIDI system exclusive message, which contains some data which identifies it as a ROCKTRON system exclusive message, as well as identifying which product it is from, and what the meaning and length of the message is, along with the actual data itself. As each block is transmitted, the display will read 'TRANSnnn', where nnn is the number of blocks transmitted so far. This number will wrap around to 0 after it reaches 255, so the final number will read 8. It will take about 10 seconds to complete the transmission.

Press the SETUP switch again to proceed from program transmit mode to program receive mode. You must be in this mode in order for the footswitch to receive program data from another footswitch (via the footswitch 'EXT' jack) or an external MIDI recorder (via the MIDI IN jack on the rear of the rack unit). The following message will be displayed: 'READY TO RECEIVE PRESS SETUP TO CANCEL'. As each block of data is received, the display will read 'RnnEmmm', where nnn is the number of blocks received so far, and mmm is the number of blocks received which were either system exclusive messages not recognized by the footswitch, or recognizable system exclusive message which contained one or more data errors. Blocks which are found to contain errors are not written to memory.

Press the SETUP switch again to proceed to the footswitch model (RSB-12F or RSB-18F) selection. This selection is necessary since both footswitch models use the exact same internal software. By selecting the RSB-12F, all that differs is that during the MIDI edit function, the data for L6 through L10 is not displayed. Since this selection is programmed at the factory, it should not normally be necessary for you to change this setting. The setting can be changed by pressing the UP or DOWN ARROW switches. Also, if the STORE switch is pressed at this time, a display test will be performed. This consists of alternately turning on each character in the display with all segments and decimal point lit. This is used at the factory to check for any problems in the display. Pressing any switch will exit this test and return to the display. Pressing any switch will exit this test and return to the footswitch model selection.

Press the SETUP switch again to proceed to the memory initialization function. This function is what is used at the factory to initialize all data to factory settings. You can use this function to restore the system to new-like settings. It will, however, erase all data you have programmed into the footswitch, so it must be used with caution. The added safeguard of having to enter a three number code has been provided to protect against inadvertent erasure by "privileged" operators and deliberate or inadvertent erasure by "unprivileged" ones. When first entering this part of the function, the following message will

be displayed: "MEMORY INITIALIZATION, WARNING - ERASES ALL DATA PRESS SETUP TO EXIT ENTER CODE TO INITIALIZE." The user can wait for this message to finish, or press a switch to stop it (except for the SETUP switch, which will cause an exit from this function). It is then necessary to enter three code numbers in order to complete the initialization. Use the UP and DOWN ARROW switches to increment or decrement the first number to a value of 51, then press STORE. Use the down arrow switch to decrement to 50, then press STORE again. Use the up arrow switch to increment to 57, then press STORE again. The word "COMPLETE" will be displayed for a few seconds, signifying the code was entered correctly and initialization occurred. If the code was not entered properly, nothing will happen.

A final press of the SETUP switch will cause the footswitch to exit the SETUP function.

VCA AND CONTINUOUS CONTROLLERS

When in the usual BANK or SONG mode, the pedal inputs on the footswitch will be read approximately 20 times a second. If there has been a change from both of the last two readings, the new value will be transmitted to the programmed controller or the VCA.

MORE ABOUT MULTIPLE FOOTSWITCH OPERATION

The RSB-12 and RSB-18 switching systems will support multiple footswitches. Two footswitches may be used with the standard cables provided. Three footswitches may be used with optional heavier gauge cables. These cables may be obtained from Rocktron or Custom Audio Electronics/Bob Bradshaw

WARNING: NEVER ATTEMPT TO USE MORE THAN 3 FOOTSWITCHES, SINCE THIS WILL EXCEED THE CAPABILITIES OF THE POWER SUPPLY IN THE RACK UNIT, LEADING TO A FAILURE TO OPERATE PROPERLY AND POSSIBLE DAMAGE TO THE UNIT.

The basic method of multiple footswitch operation was touched upon previously in the sections INTRODUCTION TO MIDI and SETTING MASTER/SLAVE/NORMAL OPERATION. To repeat, for multiple footswitch systems, one footswitch needs to be set to MASTER and the other footswitches need to be set to SLAVE via the MASTER/SLAVE switch. When a switch is pressed on a slave footswitch, the slave simply transmits a MIDI system exclusive message to the master footswitch, saying which switch number was pressed. The master footswitch then behaves exactly as if that same switch on its own front panel were pressed. It recalls the appropriate data from its own internal memory and transmits the appropriate MIDI commands to the rack. The master then transmits back to the slave footswitches data to be displayed on their displays and LEDs. The master also transmits to the slaves the MIDI controller and channel numbers for the expression pedals P1 and P2. All this happens so rapidly there is no obvious time lag between when a switch is pressed and when the action is completed. Note that the data programmed into any of the slave footswitches is not used. Therefore the slave footswitches do not have to be programmed the same as the master.

THE FUNDAMENTAL ASSUMPTION FOR PROPER MULTIPLE FOOTSWITCH FUNCTION IS THAT ONLY ONE FOOTSWITCH WILL BE OPERATED (SWITCHES PRESSED OR EXPRESSION PEDALS MOVED) AT ANY GIVEN INSTANT.

Operating two footswitches or expression pedals connected to two different footswitches at the same time may result in 'collisions' of the MIDI transmissions from the two units, and errors will result. This also means that multiple expression pedals connected to multiple footswitches must stay where they are set and not alter their readings due to gravity or vibrations.

Most of the operations and edit functions are available on both the master and slave footswitches. These include STORE, COPY, TITLES, and MIDI. However, the SETUP function is only available on a footswitch operating in NORMAL status, and only affects data within that particular pedal. When any of the other edit functions are carried out from a slave footswitch, the data within the master footswitch is what is modified. The data within the slave footswitch is not modified in any way.

When multiple footswitches are used, it is actually difficult to tell which one is the master and which are the slaves. However, there are three instances when the master and slave do behave slightly differently. The first is when you press the 2nd, then MASTER/SLAVE switches. The true status of each footswitch will be displayed on that footswitch, so that one will say MASTER and the others will say SLAVE (assuming they are set properly).

The second and third instances involve the expression pedals. Unlike the switches, the expression pedals connected to the different footswitches do not communicate their readings with each other. Instead, the slaves directly send their expression pedal readings to the rack (either to the internal VCA or other external devices capable of receiving MIDI controller changes). Because of this, when in the MIDI edit function and the VCA level is displayed, a movement of pedal 1 on the master will modify the displayed level (the level may still do real-time performance changes to the VCA level from slave expression pedals).

The third instance occurs when in the third list of the MIDI edit function during expression pedal controller number programming. Movement of the expression pedal on the master footswitch will result in the value of the pedal position being displayed only on that footswitch, and not on the slaves. Movement of the expression pedals on the slaves will not result in their values being displayed on either the master or slave.

Also, if the expression pedal on one footswitch is used, then the expression pedal on another footswitch is moved, there may be a jump in the value of the parameter being modified in the receiving device.

BRADSHAW SWITCHING SYSTEM

Date: June 22, 1989

Model: RSB-18, RSB-12

MIDI Implementation Chart

Version: 1.0

Function		Transmitted	Recognized	Remarks
Basic Channel	Default	1-16	1-16	May be saved in nonvolatile memory
	Changed	1-16		
Mode	Default	X	X	
	Messages	X	X	
	Altered	X	X	
Note Number	True Voice	X	X	
Velocity	Note On	X	X	
	Note Off	X	X	
After Touch	Key's	X	X	
	Channel	X	X	
Pitch Bend		X	X	
Control Change	0	O	X	C1 Control
	1	O	X	C2 Control
	2	O	X	C3 Control
	3	O	X	C4 Control
	0-120, Off	O	X	Controller
Program Change	True Number	O	X	**Programs 1-128
System Exclusive		O	O	Format Pages 2,3,4
System Common	Song Position	X	X	
	Song Select	X	X	
	Tune Request	X	X	
System Real Time	Clock	X	X	
	Commands	X	X	
Aux. Messages	Local On/Off	X	X	
	All Notes Off	X	X	
	Active Sensing	X	X	
	System Reset	X	X	

Notes **Actual MIDI program value sent is 0-127, corresponding to presets 1-128.

O: YES

X: NO

This table describes the system exclusive communication **from the footswitch to the rack unit only!** This communication is also transmitted out the “MIDI OUT” jack on the rack unit. The rack unit will also respond to these messages when received via the “MIDI IN” jack.

Model: RSB-18, RSB-12 MIDI system exclusive table Version:1.0

Order of MIDI bytes received by the rack unit from the footswitch unit.

	Hexadecimal	Binary
System Exclusive Byte	F0H	11110000
Manufactures ID Byte 1	00H	00000000
Manufactures ID Byte 2	00H	00000000
Manufactures ID Byte 3	29H	00101001
Product ID Byte	01H	00000001
Command Byte, Control Change	30H	00110000
Controller Number Byte	00H Thru 15H	00000000 00010101
Controller Value Byte	See correct controller number for controller value format.	

Optionally send more controller numbers followed by controller value.

End of Exclusive Byte	F7H	11110111
-----------------------	-----	----------

Note: Controller changes using controllers 0, 2, 3 are used in program changes to the rack for speed considerations. By sending control changes this way, many controllers can be set with fewer bytes.

Controller changes using controller 1, is used when setting the level of the VCA.

Controller changes using controller 14H, is used when setting the HUSH threshold level.

Controller changes using controller 15H, is used when setting C1-C4 to momentary or on/off operation.

Controller changes using the rest of the controllers are used when an individual loop or control is pressed on the footswitch, and will only affect the setting of that controller.

15H 00010101

Value Byte

b7 (MSB) = 0

b6 = 0 (reserved for future expansion)

b5 = 0 " " " "

b4 = 0 " " " "

b3 = 0 for C4 on/off operation, 1 for momentary

b2 = 0 " C3 " " 1 " "

b1 = 0 " C2 " " 1 " "

b0 = 0 " C1 " " 1 " "

CONTROLLER NUMBER

HEX	BINARY		HEX	BINARY
04H	00000100	Value Byte	00H	00000000 = HUSH out
			7FH	01111111 = HUSH in
05H	00000101	Value Byte	00H	00000000 = C1 off
			7FH	01111111 = C1 on
06H	00000110	Value Byte	00H	00000000 = C2 off
			7FH	01111111 = C2 on
07H	00000111	Value Byte	00H	00000000 = C3 off
			7FH	01111111 = C3 on
08H	00001000	Value Byte	00H	00000000 = C4 off
			7FH	01111111 = C4 on
09H	00001001	Value Byte	00H	00000000 = Loop 11 out
			7FH	01111111 = Loop 11 in
0AH	00001010	Value Byte	00H	00000000 = Loop 1 out
			7FH	01111111 = Loop 1 in
0BH	00001011	Value Byte	00H	00000000 = Loop 2 out
			7FH	01111111 = Loop 2 in
0CH	00001100	Value Byte	00H	00000000 = Loop 3 out
			7FH	01111111 = Loop 3 in
0DH	00001101	Value Byte	00H	00000000 = Loop 4 out
			7FH	01111111 = Loop 4 in
0EH	00001110	Value Byte	00H	00000000 = Loop 5 out
			7FH	01111111 = Loop 5 in
0FH	00001111	Value Byte	00H	00000000 = Loop 6 out
			7FH	01111111 = Loop 6 in
10H	00010000	Value Byte	00H	00000000 = Loop 7 out
			7FH	01111111 = Loop 7 in
11H	00010001	Value Byte	00H	00000000 = Loop 8 out
			7FH	01111111 = Loop 8 in
12H	00010010	Value Byte	00H	00000000 = Loop 9 out
			7FH	01111111 = Loop 9 in
13H	00010011	Value Byte	00H	00000000 = Loop 10 out
			7FH	01111111 = Loop 10 in

Example of a System Exclusive Message Sent to the Rack

Send Bytes in this Order

	Hexadecimal	Binary	
System Exclusive Byte	F0H	11110000	
Manufactures ID Byte 1	00H	00000000	
Manufactures ID Byte 2	00H	00000000	
Manufactures ID Byte 3	29H	00101001	
Rack Product ID Byte	01H	00000001	
Command Byte, Control Change		30H	00110000
Controller Number Byte	00H	00000000	To change controller 00H
Controller Value Byte	2BH	00101011	HUSH in C1 on C2 off C3 on C4 off L11 in
Controller Number Byte	0DH	00001101	To change controller 0DH
Controller Value Byte	7FH	00000000	Loop 4 out
Controller Number Byte	14H	00010100	To change controller 14H
Controller Value Byte	24H	00100100	To set HUSH threshold To -30dB
End of Exclusive Byte	F7H	11110111	

This example has set:

HUSH in
C1 on
C2 off
C3 on
C4 off
L11 in
L4 out
HUSH threshold to -30dB

The rest of the loops and the VCA are left unchanged.

TROUBLESHOOTING CHART

DESCRIPTION OF PROBLEM

POSSIBLE CAUSE AND REMEDY

1. Nothing lights on either the rack or footswitch units.

1A. Rack unit not getting proper AC power - check AC power connections.
1B. Is the rack power switch pushed in?
1C. Fuse blown - check fuse (disconnect AC power cord first) and replace if open. Use only 1/2 amp 'regular blow' (not slow blow) fuse.
1D. Serious internal problems with the rack or footswitch units - have serviced by Rocktron authorized technicians.

2. Rack power LED lights, but nothing lights on the footswitch (including 2nd LED when 2nd switch is pressed).

2A. Is the cable between the rack and footswitch units connected?
2B. Footswitch processor 'crashed'- turn off power switch. Wait a few seconds, then turn back on.
2C. Faulty cable - have repaired or replaced.
2D. Serious internal problems with the footswitch or rack units - have serviced by Rocktron authorized technicians.

3. Rack power LED lights, some footswitch LEDs and/or display segments are lit, but nothing works when footswitches are pressed.

3A. Footswitch processor error - turn off power switch, wait a few seconds, then turn back on.
3B. Serious internal problems with the unit- have serviced by Rocktron authorized tech.

4. Footswitch works normally, but rack does not respond.

4A. Rack processor crashed - turn off power switch, wait a few seconds, then turn back on.
4B. Faulty cable - have repaired or replaced.
4C. Internal problem with rack or footswitch - have serviced.

5. 2nd LED on footswitch lights when 2nd switch is pressed, but nothing else seems to work.

5. Footswitch is in SLAVE state - change to NORMAL or MASTER state using MASTER/SLAVE function switch.

6. Footswitch almost operates normally, but L1 to C4 switches do not function normally.

6. Trapped in COPY function if COPY LED is lit when 2nd LED is lit - activate 2nd function by pressing 2nd switch to light 2nd LED, then press COPY to exit COPY function.

7. External device(s) not responding to expected MIDI program or control changes.
- 7A. Is MIDI OUT on rear of rack unit properly connected to MIDI IN of first external device, and MIDI THRU of each external device connected to MIDI IN of following external device?
 - 7B. Bad MIDI cables - repair or replace.
 - 7C. Improper setting of MIDI channel numbers - check that transmit channels programmed into footswitch unit correspond to receive channel settings on external devices.
 - 7D. Improper setting of MIDI program change values - check that program change values are properly programmed into footswitch (did you remember to press STORE)?
 - 7E. External devices not properly set up - check that they have MIDI reception enabled, program change and controller mappings are properly set, etc.
 - 7F. Failure to understand that program changes are only transmitted for those switches (L1 to C4) that are on (LEDs lit)
8. Multiple footswitches not operating in unison.
- 8A. Improper setting of MASTER/SLAVE - set one footswitch on MASTER and the other one(s) on SLAVE.
 - 8B. Bad connection between master and slave(s) - repair or replace cable(s).
9. Mysterious, intermittent errors in the operation of the rack and/or footswitch(es).
- 9A. Two or more footswitches are being operated (switches pressed or expression pedals moved) at the same time, leading to data 'collisions' - only operate one footswitch at a time.
 - 9B. A MIDI source plugged into MIDI IN jack on rear of rack unit is transmitting simultaneously to the footswitch unit, resulting in 'collisions' between the two data streams - disconnect source at MIDI IN or do not operate footswitch when the external source is transmitting (the MIDI IN jack should probably only be used to transfer in programs from an external storage device, then be disconnected).

10. Expression pedals do not work.

10A. Cables not connected properly - each expression pedal jack on the footswitch is a stereo jack which typically requires an external splitter connector to form two mono jacks. The input mono jack of the external expression pedal should connect to the tip and sleeve of the footswitch P1 or P2 jack and the output mono jack of the external expression pedal should connect to the ring and sleeve of the same footswitch P1 or P2 jack. Check value readings within MIDI edit function for pedal controller numbers.

10B. Expression pedals not programmed properly within MIDI edit function - check programming in terms of proper controller numbers (or VCA) and channels (channel number ignored when controller number set to VCA). Remember, the programmed values for these items may change for every preset, so they may work as desired on some presets but not on others.

FCC NOTICE

This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the product with respect to the receiver
- Move the product away from the receiver
- Plug the product into a different outlet so that product and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful. "How to Identify and Resolve Radio-TV Interference Problems."

This booklet is available from the:

U.S. Government Printing Office
Washington, D.C. 20402
(Stock Number 004-000-00345-4)

MAINTENANCE

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

SPECIFICATIONS

RFI Shielding: Meets FCC Class B computing device equipment requirements.

INPUT

Input Impedance 500K Ohms
Max. Input Level +20dBu

DYNAMIC RANGE

130dBu "A" weighted

COMPOSITE SPECIFICATIONS

(All test with signal passing through all the loops. Loops all IN).

Composite Frequency Response +/- 0.5dBu from 30Hz to 20KHz
Composite Residual Noise -110dBu "A" weighted
Composite Distortion less than 0.2% THD @ 1KHz

PROGRAMMABLE VCA

Distortion less than 0.04% THD @ 1KHz
Attenuation unity gain to -77dBu (programmable)

PROGRAMMABLE HUSH

Distortion less than 0.05% THD @ 1KHz
Effective Noise Reduction up to 55dB
Threshold Range 0dBu to -70dBu (programmable)

RIGHT/LEFT HUSH (RSB-18R ONLY)

Distortion less than 0.05% THD @ 1KHz
Effective Noise Reduction up to 55dB
Threshold Range 0dBu to -70dBu

LOOP MIX RANGE

infinite attenuation to 5.5dBu

OUTPUT

Output Impedance less than 100 Ohms
Max. Output Level +20dBu

MIDI CONNECTORS

Standard 5-pin DIN

FOOTSWITCH

Momentary Contact Time 65msec

POWER REQUIREMENTS

Fuse 110/120 VAC @ 50/60Hz
0.5A Regular Blow

DIMENSIONS

Rack 19" x 10-1/2" x 3-1/2"
Footswitch 24" x 12" x 4"

NOTE: 0dBu = 0.775V RMS

WARRANTY

All parts and workmanship of this Rocktron product are fully guaranteed to be free of defects under normal use and service for a period of ONE year from date of purchase.

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

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

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

Should this Rocktron product require repair, Rocktron will assume responsibility for repair service. Do not return the product to the dealer. Simply repack the unit, sending along a description of the problem to: Rocktron Corporation, 2870 Technology Drive, Rochester Hills, MI 48309. All shipping charges must be fully prepaid.

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

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

There is no other express warranty on goods covered by this agreement.

PART# 098-0066
FORM # 134 - 6/89