

*CHROMA*™ *Polaris*™

**OWNER'S MANUAL**

\\The Polaris Manual

WARNING

To reduce the risk of fire or electric shock do not expose your Polaris to rain or moisture.

WARNING

No user serviceable parts inside. Refer battery replacement, line voltage selection, fuse replacement and other servicing to qualified service personnel.

WARNING

This equipment has been tested to comply with the limits for a Class B Computing Device, under Sub-part J of Part 15, of FCC rules. Only peripherals (Input/Output devices, Expanders, Computers, other synthesizers, etc.) certified to comply with the Class B limits may be attached to your Polaris. Operation with non-complying peripherals is likely to result in interference to radio and TV reception. Furthermore, only Fender footswitches and pedals may be used with this synthesizer, since operation with pedals and footswitches not properly wired or shielded may cause interference.

RADIO AND TELEVISION INTERFERENCE

The Polaris generates and uses radio-frequency energy. If it is not installed and used properly, that is, in strict accordance with our instructions, it may cause interference with radio and television reception.

The Polaris and its accessories have been tested and fall within the limits for a Class B computing device in accordance with the specifications in Sub-part J, Part 15, of FCC rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee interference will not occur in a particular installation, especially if you use a "rabbit ear" (indoor) television antenna. If you experience interference, refer to Chapter 17 for possible solutions.

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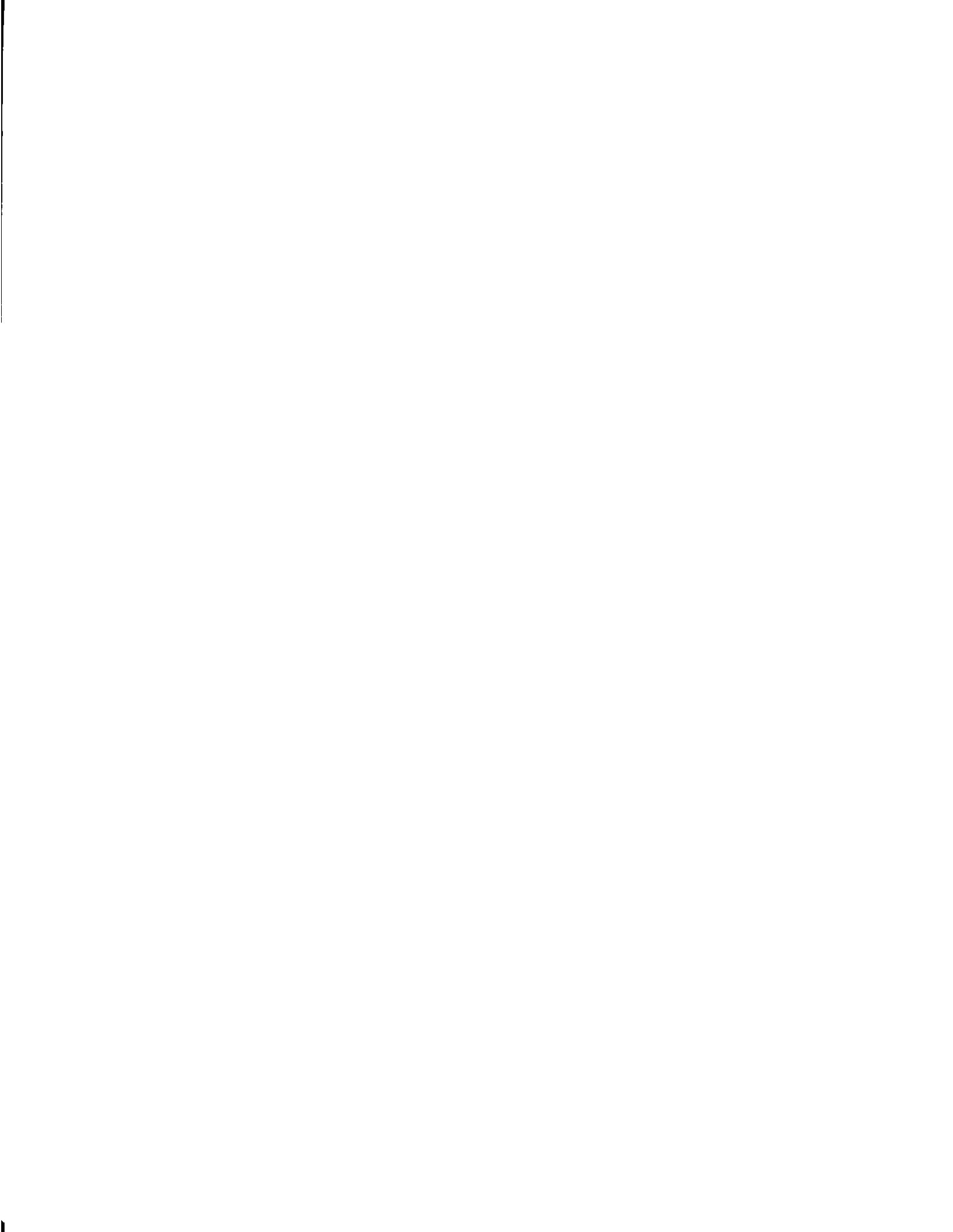
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\\The Polaris Manual  
WELCOME

By the time you get around to reading this, you probably will already have gotten your Polaris home, plugged it in, and played with it until either your fingers became sore or somebody else told you to go to bed, for heaven's sake. Nevertheless, welcome to the Polaris. As you no doubt know by now, the Polaris is a hybrid: half musical instrument, half computer, half keyboard controller, and half sequencer. If you are thinking there are too many halves in that last statement, wait until you get to know Polaris a little better.

It's a safe bet the first thing you noticed about the Polaris was its sound. Rich, analog sound. The kind of sound you buy a musical instrument for. All the buttons in the world don't mean a thing if they don't make your ears happy. But the Polaris sound is only half of the story.

You might have noticed we stored 132 different programmed sounds in the Polaris to give you a head start on the almost limitless possibilities of your instrument. You might even have heard that a computer keeps track of them all. You might not have heard that the Polaris computer is based on a more powerful chip than the one in most microcomputers (including the one with three initials in the name). But the Polaris computer is only half of the story.

What keyboard player these days isn't aware of the Musical Instrument Digital Interface (MIDI)? So you made sure the Polaris had all the proper ins and outs. The Polaris features both the MIDI and the Chroma Interface, so you can control other MIDI devices or interface with your home computer to your heart's content. But the Polaris interfaces are only half of the story.

Maybe you haven't gotten the sequencer working yet, but boy-oh-boy, when you do....A few years ago, you wouldn't have been able to find a flight case that could hold all the equipment the Polaris replaces. Now, you've got a 700 note (reconfigurable to over 1700 note) sequencer at your fingertips, and it's as easy to use as the Polaris because it's built right in. But the sequencer is only half of the story.

We should stop talking about how great the Polaris is and get on with the rest of the manual. After all, if we get started talking about the Polaris' Dynamic Voice Allocation, or its Selective Pitch Bend, or the Tempo Tap, or the Assignable Control section, or the fact that it is fully polyphonic (six voices), or how incredibly easy it is to use live (engineers call it "real time playability"), we'll be so busy raving about the Polaris there won't be any time left to use it.

So again, welcome, and enjoy. We had a blast designing the Polaris; we know you'll have a blast playing it.



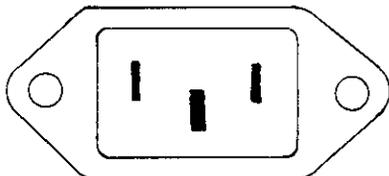
## CHAPTER 1/LET'S GO!

### BASIC POLARIS HOOK-UP PROCEDURE

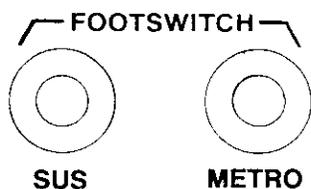
This section of the manual will allow you to begin using your Polaris very quickly. Many more features will be explained further in the manual, but for the moment you should spend some time playing your Polaris and exploring the pre-programmed sounds.

#### Connections

1) Connect the power cord first to the receptacle under the on/off switch, then to the AC source.

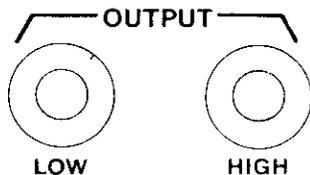


2) Connect the two provided footswitches to the jacks marked SUS and METRO.



One of these switches is the Sustain Footswitch (SUS) and the other is used with the Sequencer (METRO). We suggest you put a mark on one of the footswitches so you will remember which switch performs what function. Something as simple as a piece of tape on one switch will be adequate. You will want to get into the habit of always orienting the footswitches the same way each time you set up your Polaris. Since the Sequencer is on the left side of the Polaris control panel, you might want to put the Sequencer Footswitch to the left of the Sustain Footswitch.

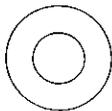
3) Connect the Polaris to your audio source (amplifier, mixing console, sound system, etc.). The jack marked HIGH will usually provide the most usable signal.



NOTE: You can use one or the other of the outputs, but not both. If you plug cords into both jacks only the HIGH output jack will work. The two OUTPUT jacks on the rear panel are NOT stereo. It is not possible to have stereo output from the Polaris.

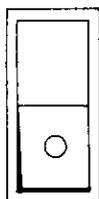
A headphone jack is also provided; it can be used as an audio output as well, although it should not be used at the same time as the LOW or HIGH outputs.

**HEADPHONE**



4) Turn on the Polaris. The switch is at the back of the unit on the left.

**POWER**



When the Polaris is on, several of the LEDs (Light Emitting Diodes) on the control panel will be lit.

5) If the LED above the MASTER slider is on, press its switch to turn it off. Then set the master slider to a mid-point for the overall volume of the instrument.

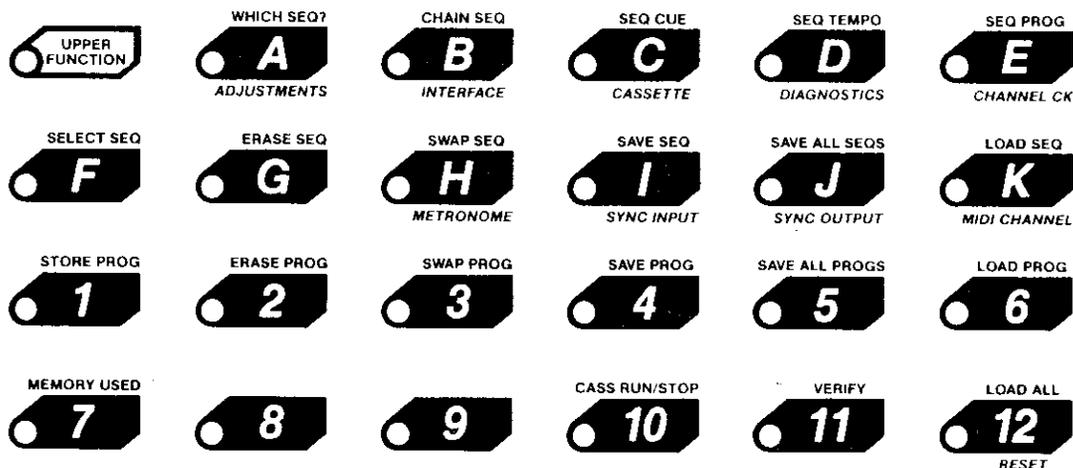
**MASTER**



## SELECTING A SOUND

The sounds or voice programs are stored in the memory of the Polaris. To select a program, both a letter switch and a number switch must be selected from among the bank of switches on the right side of the control panel. After you have selected a letter switch, you may change programs by pressing a number switch without pressing the same letter switch again.

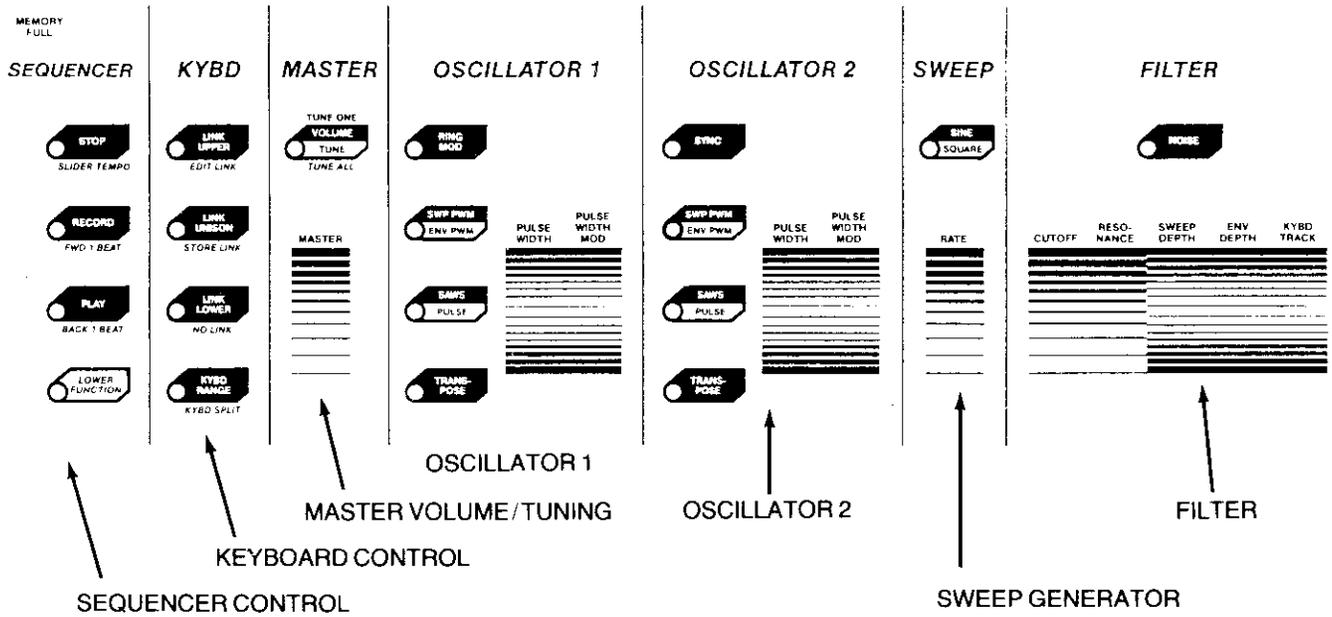
### BANK SELECT/PROGRAM SELECT



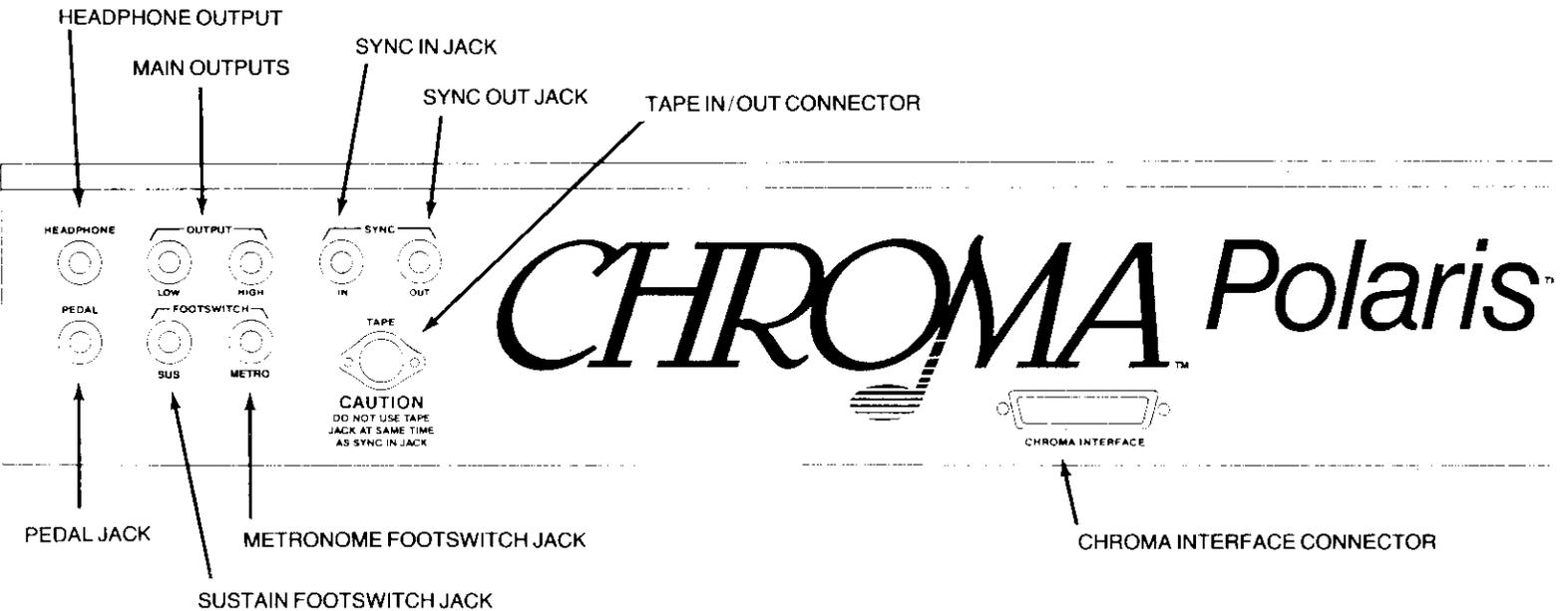
When a letter switch is pressed, the computer in the Polaris will light up those number switches with programs stored in them. Press any of the lit switches to select a program within the bank you have selected. Your Polaris was shipped with 132 sounds programmed into its memory. A list of the programs can be found in Chapter 16.

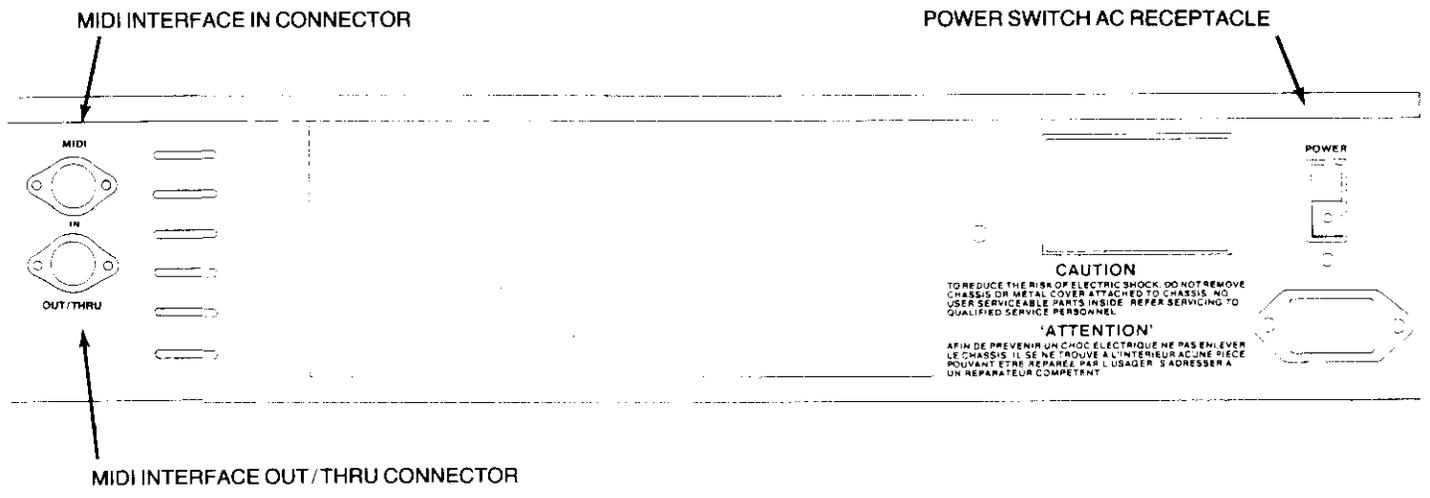
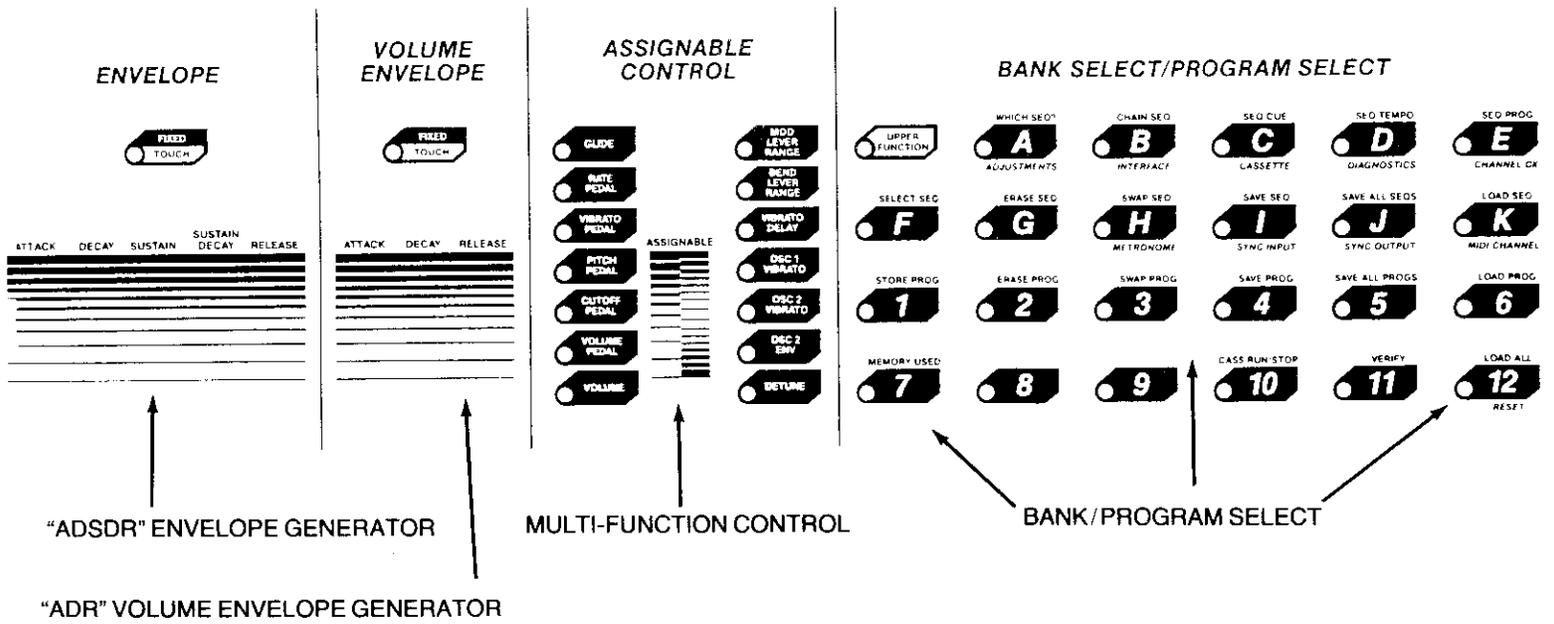
You can change sounds as many times as you want. When you are ready to learn more about the Polaris, turn the page.

# FRONT PANEL CAPTIONS



# BACK PANEL CAPTIONS







## CHAPTER 3/BASIC SYNTHESIZER STRUCTURE

### BASIC SYNTHESIZER STRUCTURE

#### Why a Synthesizer is Different from Other Instruments

The modern synthesizer offers the performer new ways to deal with the properties of sound. These properties of sound --- pitch, timbre (tone color), and loudness --- can be synthesized to either duplicate familiar sounds or to create novel ones. Prior to the inclusion of electronics in the design of musical instruments, these sound properties were built-in parts of an instrument. It was impossible to change one aspect of the instrument's sound without affecting other aspects. For instance, when a trumpet is played loudly, the tone is very bright; when played softly, it is more mellow. Changing the amplitude of the instrument also changes the timbre. Built-in relationships among sound properties such as this are typical of acoustic instruments.

Another characteristic of acoustic instruments is their inability to step outside of their designed parameters to create other pitches, timbres or amplitudes. Their form (shape, design, construction, and material) determines their function. You can't create clarinet sounds using a gong.

With electronic musical instruments "form" and "function" need be carefully defined. The external form of the synthesizer allows the musician to control a changeable internal form. That is, the physical construction, size, and shape of the synthesizer doesn't dictate the sounds it produces. The way its electronic elements are connected, controlled, and calibrated does. And, most important, with electronic musical instruments it is possible to manipulate sound properties as though they exist abstractly, since their creation and interrelation with other sound properties are at the mercy of the musician.

#### The First Synthesizers

The early versions of the synthesizer exemplified this independence in the control of sound properties. Their modular construction offered separate components that could be used like building blocks to provide independent and variable control over sound properties. An inexpensive and reliable way to connect these modules was with cables called "patch cords." Synthesizers designed specifically for live performance --- such as the Polaris --- let you connect sections (modules) of the instrument using panel controls and computer memory instead of patch cords. Since we no longer use patch cords, the interconnection of synthesizer modules is now often referred to as a "program."

So we can better understand the Polaris, let's continue to think of the synthesizer as a collection of modules doing different things; modules requiring patch cord connection. Since sound has the properties of pitch, timbre, and loudness, it follows that our

synthesizer has modules dealing with each property.

### **SYNTHESIZER SOUND MODULES**



#### Where the Sound Comes From

The synthesizer's basic output is electronic signals that when amplified and fed to a speaker are translated into sounds. Not surprisingly, synthesizers have audio signal generators to create these electronic signals. These signals are unrefined tones or noise that you shape into the sound you desire. This is the first step in synthesizer sound creation, and is somewhat akin to blowing only through the mouthpiece of a trumpet.

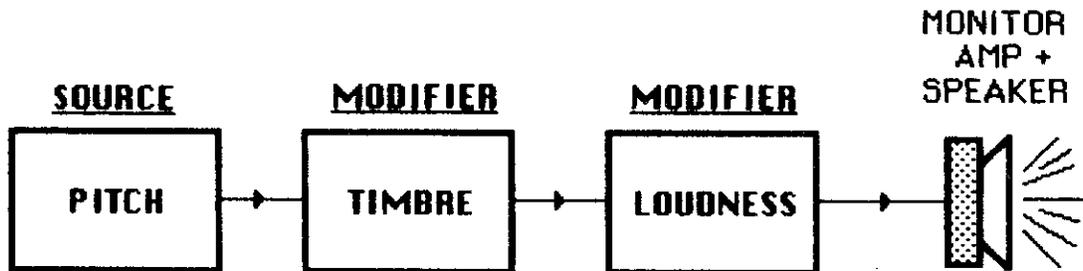
We need at least two things to get sound from a synthesizer: an audio signal generator to act as a sound source and a speaker to translate the resulting electronic signal into an audio signal.

### **MINIMUM AUDIO "PATCH"**

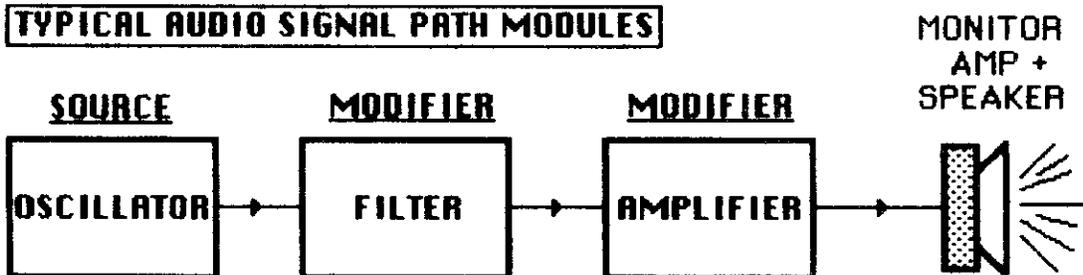


### How the Sound is Modified

The sound produced by this most basic of patches is not very musical. Coincidentally, we have very little control over it. We either like everything about it and let it continue, or we don't like it and unplug it. The next step is to increase our control over the sound generated by the audio signal generator by inserting timbre and loudness modifiers between it and the speaker.



Now let's begin to use synthesizer terminology. The audio signal generator is called an oscillator, the timbre-modifying module is called a filter, and the loudness modifier is called an amplifier. The diagram below shows a typical audio signal path with the technical names for each module.



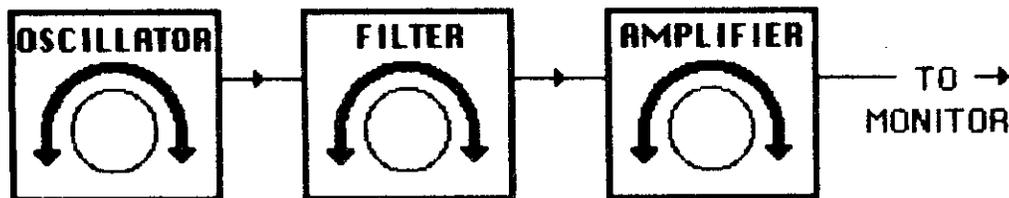
The timbre module on most synthesizers acts somewhat like a trumpet mute. Both devices modify sound by changing the tone color, or timbre.

The loudness module is another modifier, like the bell of the trumpet, which helps radiate the sound.

Once you make this patch, you have a little more control over the output of the the oscillator, but you still don't have any control over the oscillator itself, nor can you control the timbre of the filter, or the loudness of the amplifier. It is still a "take it or leave it" proposition.

#### Using Voltage to Control the Modules

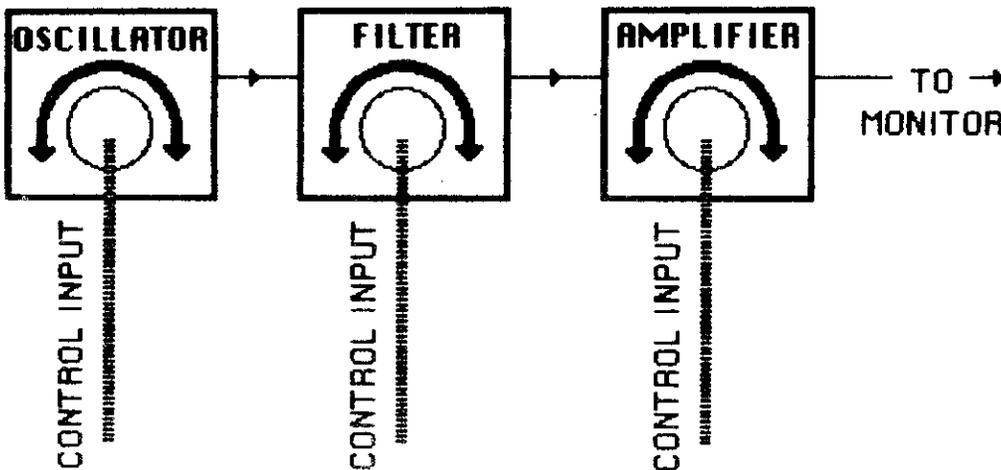
To control the oscillator, filter, and amplifier, you must control the voltage controlling them. One method of controlling this voltage is with potentiometers, also referred to as "sliders" or "pots." The Polaris has a number of sliding potentiometers for controlling filter cutoff, pulse width, sweep rate, etc. Once we have a slider on each module, we can control its function --- pitch generation, timbre or amplitude --- by altering the position of the slider.



#### Other Voltages We can Control

We now have a voltage-controlled instrument we can program and play using three sliders, although playing music using just sliders would be restrictive at best. Fortunately, the Polaris offers you many ways of creating voltages to control its modules.

#### CONTROL INPUTS



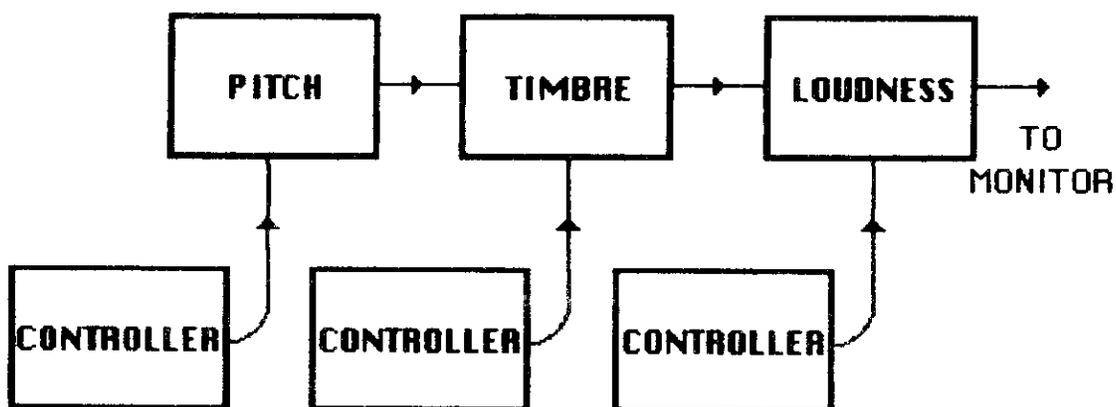
Now we can route control signals (voltages) into the control input of each module shown above to dynamically control its function. Each module may have several control inputs, and is capable of adding all voltages applied to it.

There are many possibilities for controlling modules with voltage, but three are most common. They are the voltage-controlled oscillator (VCO), voltage-controlled filter (VCF), and voltage-controlled amplifier (VCA). From now on we will refer to these modules by their three letter abbreviations.

#### Controllers

When a signal is connected to a control input it acts as a controller. On a modular synthesizer the output of a controller would be connected to the module's control input with a patch cord.

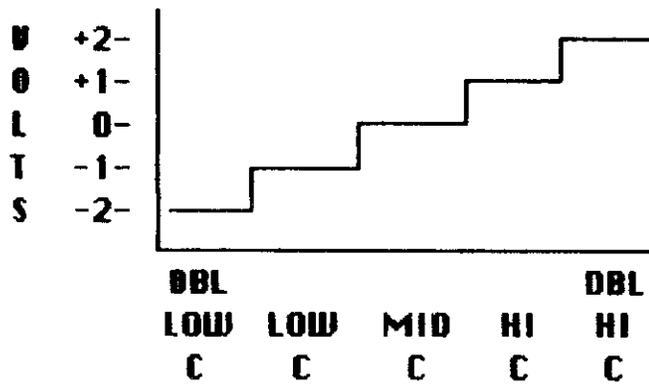
### CONTROLLER-CONTROLLER INPUT CONNECTION



Let's look at some of the types of controllers typical of synthesizers.

#### Keyboards

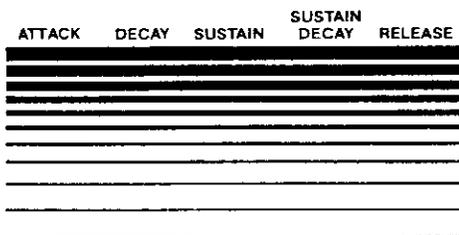
We tend to think of a keyboard as a pitch controller. If it is connected to the control input of a VCO, it will behave in its traditional role. In a synthesizer, however, the keyboard output is in the form of voltages that, when applied to the control voltage input of the oscillator, cause the oscillator to generate the correct pitches.



This keyboard output could be connected to any control input. For instance, if connected to the filter, the brightness would increase as you play up the keyboard.

### Envelope Generators

An envelope generator is a controller that creates a rising and falling voltage pattern, the shape of which can be set by multiple sliders, each slider controlling one phase of the life of the control voltage the envelope creates. The term envelope describes the shape of the control voltage. It is not surprising to find an envelope generator connected to the amplifier module control input on virtually every synthesizer. This lets you shape loudness or articulate the sound.



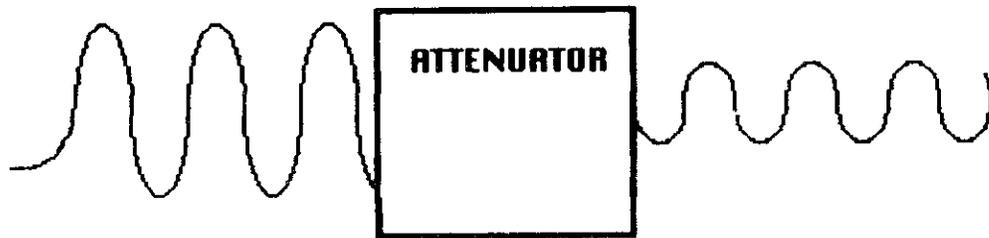
The filter is usually controlled by an envelope generator, too. When this is the case, the timbre will typically become brighter as the envelope voltage rises and duller as it falls.

### Sweep Generator

The sweep generator is actually a very low frequency oscillator whose output can be mixed in with other control signals. When mixed in with the pitch control voltage from the keyboard, it adds vibrato to the sound. When mixed in with the filter control voltage, the timbre fluctuates, creating a tremolo effect.

### Attenuators

The output of VCOs, VCFs and VCAs is normally more than needed. This is not always desirable, so some means of reducing the output level must be provided. This is the job of the attenuator. The attenuator makes smaller signals out of bigger ones.

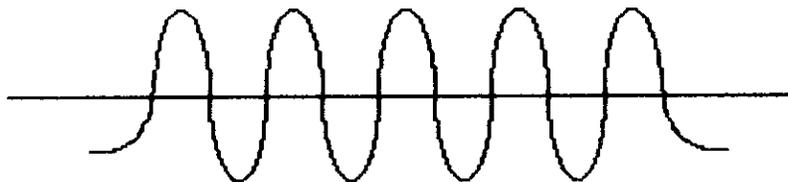


The Polaris has a number of attenuators. The most obvious is the volume control slider in the MASTER section. Additionally, the FILTER section features three sliders, SWEEP DEPTH, ENV DEPTH, and KYBD TRACK. Each of these sliders lets you attenuate (reduce the amount of) the signal modifying the filter. When you attenuate a control signal that is creating vibrato, you can control the depth of the vibrato. Attenuating the control signal reduces the vibrato depth commensurately.

#### Types of Attenuators

It is important to know attenuation always occurs toward zero voltage, regardless of whether the signal is positive or negative. Some control signals on the Polaris are "bipolar," because their voltages move from positive through zero to negative.

#### **BIPOLAR VOLTAGE**



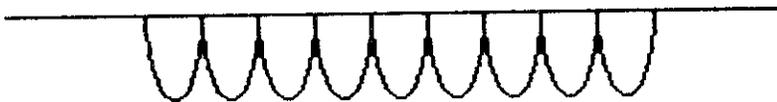
"Unipolar" signal voltages change from zero volts to a positive voltage.

**UNIPOLAR**



"Inverted Unipolar" signals range from zero through negative voltage levels.

**INV. UNIPOLAR**

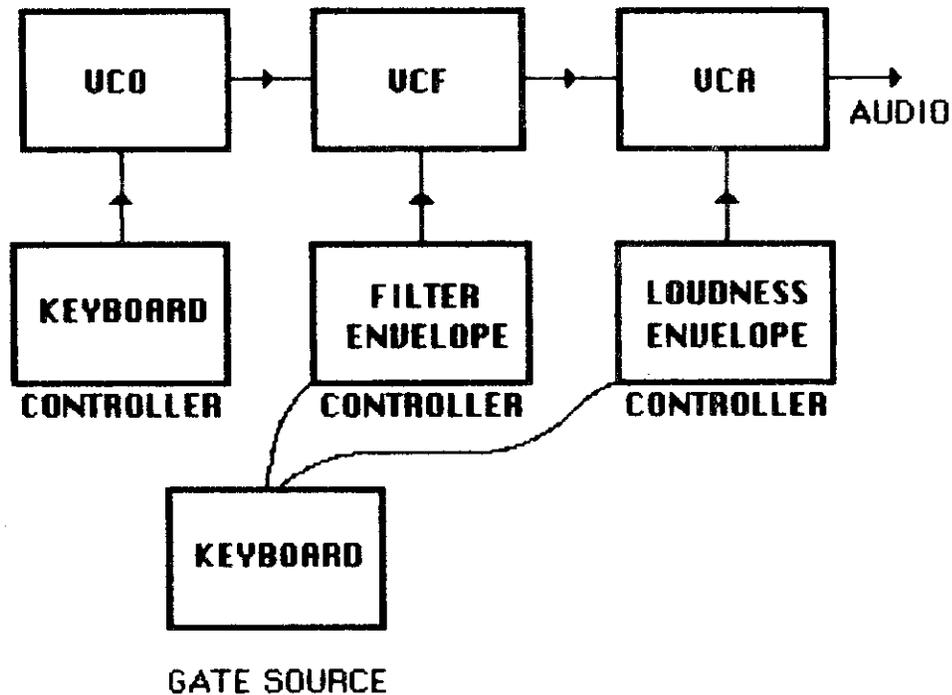


To accurately predict the effect a control signal will have on a voltage-controlled module, you must be aware of how the signal fluctuates in relationship to zero volts, and remember any attenuation reduces the signal back toward zero volts. If you have a difficult time grasping this concept, don't worry about it right now. You will be able to use the Polaris without a degree in electronics, and as you become more experienced the use of the various attenuators will become second nature.

**Gates**

We have to tell the envelope generator when to start and when to stop creating an envelope. For this purpose the synthesizer produces another type of signal called a "gate." The keyboard creates a gate that tells when a key is depressed and when it is released. The rising segment of the envelope begins when a gate comes on. The falling (final) segment of the envelope begins when the gate is off.

## SYNTHESIZER BLOCK DIAGRAM (BASIC)



### Adding a Computer to a Synthesizer

The voltage-controlled synthesizer has several elements: sound sources, modifiers, controllers, attenuators and gates. Sound sources make audio signals, modifiers alter signals (either audio or control), controllers generate signals to control sound sources and modifiers, attenuators control the amplitude of signals and gates provide timing information that tells the envelope generators when to act. In the early synthesizers, these components were interconnected with patch cords.

One of the limitations of such a system is that all patches and adjustments must be done manually, which takes time. If you could reduce the amount of time it takes to change patches and adjustments, you would have a much more versatile instrument. This is where the computer comes in. The computer in the Polaris is extremely fast, and it can make thousands of changes in the same amount of time it would take to change just one patch cord.

A control voltage generated by the keyboard (for controlling pitch) is fine for many synthesizers, but it limits the synthesizer to one note at a time. The computer in the Polaris can detect when notes on the keyboard are pressed and released and assign voices as they are needed, even if more than one key is pressed. This makes the Polaris polyphonic.

One other thing the computer does for the Polaris is perhaps the most exciting thing of all. It knows the way the switches and sliders were set for a particular sound, and it can store this information in its memory as a program to be recalled at any time. And, since the switches and sliders on the Polaris are all connected to the computer (instead of the synthesizer circuits), you can change any program either temporarily or permanently after you've saved it.

After you get used to playing the Polaris, you'll wonder why synthesizers haven't always had computers.

## CHAPTER 4/THE POLARIS CONTROL PANEL

### THE POLARIS CONTROL PANEL

#### Programming Parameters

Creating a sound with the Polaris, or modifying an existing sound, involves adjusting the "description" of the sound. Most of the panel controls directly affect the sound's description. For the sake of simplicity, the control panel will be described from left to right. If you are just getting started with the Polaris, you might want to skip over the Sequencer and Keyboard control sections for now.

Once you understand the basics of the control panel, you can refer to later chapters for detailed information.

#### Notation Used In The Explanations

The Polaris has many more functions than there are controls on the front panel. Therefore, certain functions involve pressing more than one switch in sequence. In order to keep the explanations of all the functions easy to understand, this manual will use a simple and consistent notation for denoting different combinations of switches.

Illustrated switches appear in the manual the way they do on the control panel. For example, if an operation required setting the keyboard range, you would be asked to press the switch that looks like this:

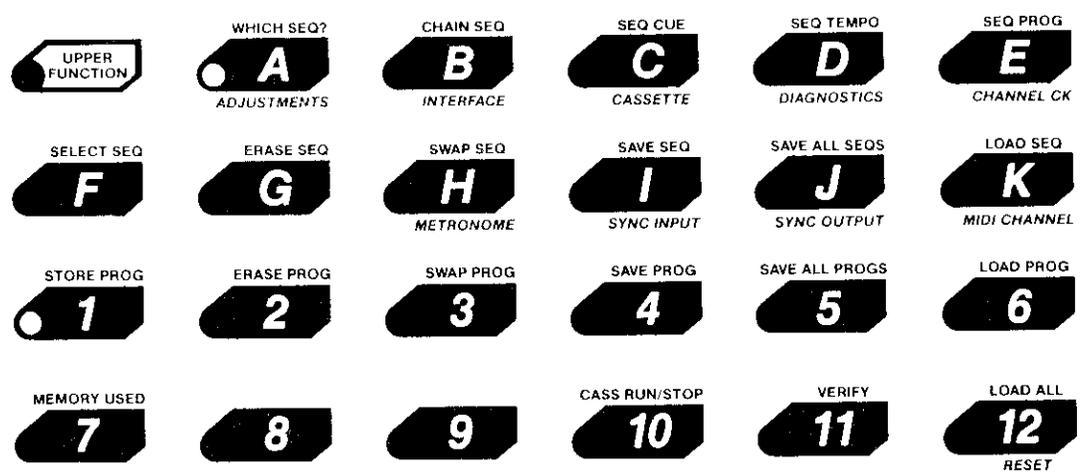


When switches are to be pressed in sequence, their icons will appear one after another, such as:



When a combination of switches involves making a selection using the letter and number switches, the switch will be shown as it appears on the control panel. If there is a range of letter or number switches that may be selected, the range will be indicated within the picture of the switch.

### BANK SELECT/PROGRAM SELECT



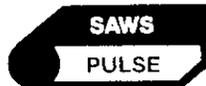
When a group of switches is shown, the active switch(es) will be shown with the LED in white.



If, after pressing a switch, the LED flashes, it will be shown with the LED half white and half black.

NOTE: The control panel has several switches with two labels in them. The label in black letters against the background color indicates the function when the LED is off, while the label in white letters against the black background indicates the function when the LED is on.

This shows the waveform switch with "SAWS" selected.

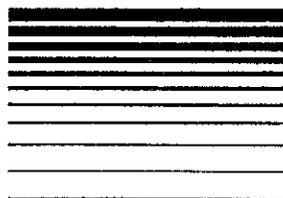


This shows the same switch with "PULSE" selected.

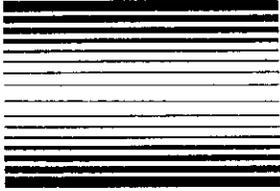


#### Unipolar and Bipolar Sliders

In Chapter Four (Basic Synthesizer Structure), reference was made to unipolar and bipolar sliders. The graphics on the Polaris make it easy to remember which are which.



This is a unipolar slider. At the bottom, the lines are farther apart than at the top, indicating that the zero point is at the bottom.



This is a bipolar slider. The lines are farther apart at the center than they are at either extreme, indicating that the zero point is in the center.

#### Lower and Upper Function Switches

The most important switches on the control panel are labelled LOWER FUNCTION and UPPER FUNCTION. As you might guess, these are used to access secondary functions that do not have their own switches. If you press LOWER FUNCTION, its LED will flash, indicating the Polaris is expecting you to press another switch. The function of the next switch you press is determined by what is written BELOW the switch, not on it or above it. Similarly, if you press UPPER FUNCTION, its LED will flash, and the next switch you press will activate the function written ABOVE the switch. At any time during a lower or upper function, you can abort the operation by pressing LOWER FUNCTION or UPPER FUNCTION again.

#### SEQUENCER

MEMORY FULL

#### SEQUENCER

This section contains three switches and LEDs for controlling the Sequencer, plus one additional switch with an LED and an LED with no switch. The last switch, labelled LOWER FUNCTION, is covered above. The single MEMORY FULL LED at the top of the SEQUENCER Section will be covered in Chapter 8.



At any time the Sequencer will be in either Stop, Play or Record mode, as indicated by one of the three LEDs in this section. In addition, if the internal metronome is running, the LED will also flash on each beat. The primary function of the switches is to put the Sequencer into a different mode.



There are also Lower Functions under these switches to allow some sequence editing. SLIDER TEMPO allows manual manipulation of the metronome, while FWD 1 BEAT and BACK 1 BEAT allow you to cut and paste beats to the ends of your sequences.



## KYBD

### KYBD



This section contains four switches with LEDs. LINK UPPER, LINK UNISON, and LINK LOWER allow the performer to play two sounds at once. LINK UPPER assigns the linked sound to the upper section of the keyboard. When LINK UNISON is selected, both the main and the linked sound play throughout the entire keyboard. LINK LOWER assigns the linked sound to the lower section of the keyboard. KYBD RANGE allows the keyboard to be transposed up an octave.

There are four lower functions in the KYBD Section. EDIT LINK allows you to modify the linked sound without affecting the main sound. STORE LINK allows you to save the link for later. NO LINK clears out a link, and KYBD SPLIT sets the point at which the keyboard is split during a link. The function of the KYBD RANGE switch is explained later on in this chapter in the section dealing with the keyboard itself.

### MASTER

#### MASTER



This section contains a dual purpose slider, whose function is selected by the switch above it.





When the LED is on, the slider functions as a master tuning control, adjusting the overall pitch of the instrument plus or minus one semitone relative to true concert pitch.

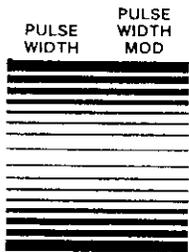


When the LED is off, the slider functions as a master volume control. In addition, there are Upper and Lower functions for the switch in this section that give the Polaris the ability to tune its voices.

Some special modes use the MASTER slider for other purposes (such as the SLIDER TEMPO). The original functions are restored when the special modes are exited.

### OSCILLATOR 1

#### OSCILLATOR 1

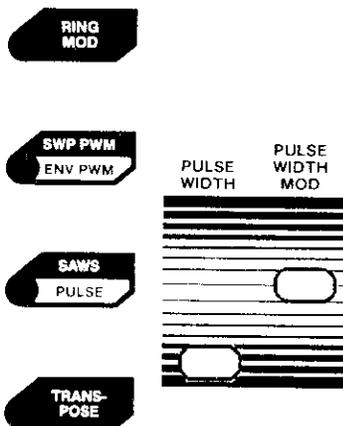


An oscillator is a basic tone generation source. The Polaris has two oscillators. Each oscillator can be transposed in semitones over a wide range, and OSCILLATOR 2 can be detuned up to a semitone sharp. Vibratos and trills can be applied to the oscillators via the Mod Lever (see the Mod and Bend Lever section later in this chapter), with an adjustable depth. Delayed vibratos and trills can also be applied directly to the oscillators. The depth of this type of modulation is adjustable independently for both oscillators, and can have positive or negative polarity. OSCILLATOR 2 can be synchronized to OSCILLATOR 1, and OSCILLATOR 2 can be modulated by the ENVELOPE, especially useful with SYNC.

The two basic shapes available are pulse and sawtooth. The pulse width is adjustable from 0% to 100%, and can be modulated by either the SWEEP or the ENVELOPE. The PULSE WIDTH slider affects the sound of both the pulse and sawtooth shapes.

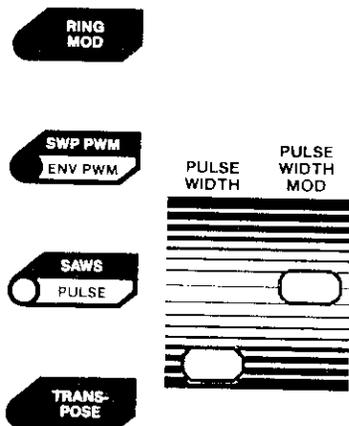
A simple sawtooth shape:

### OSCILLATOR 1



Turning off an oscillator:

### OSCILLATOR 1



A black rectangular switch with a white circle on the left side. The text "RING MOD" is printed in white on the black background.

When this function is selected, the two oscillators' signals are replaced by the digital cross-product of the two pulse signals. In this mode, the SAWS/PULSE switch has no effect, but the PULSE WIDTH control does.

A black rectangular switch with a white circle on the left side. The text "SWP PWM" is printed in white on the top half, and "ENV PWM" is printed in white on the bottom half.

This switch selects the kind of modulation to be applied to the pulse width. When the LED is off, sweep modulation is selected. When the LED is on, envelope modulation is selected.

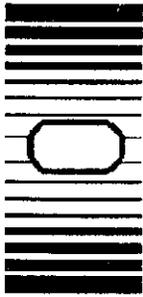
A black rectangular switch with a white circle on the left side. The text "SAWS" is printed in white on the top half, and "PULSE" is printed in white on the bottom half.

This switch selects the basic wave shape produced by the oscillator.

A black rectangular switch with a white circle on the left side. The text "TRANS-POSE" is printed in white on the black background.

Pressing this switch causes its LED to turn on, indicating that the next keyboard key pressed will set the tuning of the oscillator. Nominal tuning of this oscillator is obtained by pressing this switch followed by the C one octave above the lowest note of the keyboard. Thus, the oscillator can be tuned up to an octave down or up to four octaves up.

**PULSE WIDTH**



This slider adjusts the initial pulse width of the oscillator from 0% to 100%. There is a significant dead zone in the middle of the slider, making it easy to set the parameter to precisely 50%. The range of sounds obtainable depends upon the setting of the SAWS/PULSE switch, and is best understood by experimenting with it.

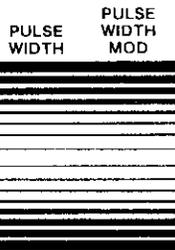
**PULSE WIDTH MOD**



This slider adjusts the modulation depth of the pulse width. There is no modulation when this is centered. Raising the slider results in normal modulation. Lowering it results in modulation whose depth is proportional to pitch. This latter mode is most useful with sweep modulation, as it equalizes the apparent depth of the effect across the keyboard.

**OSCILLATOR 2**

**OSCILLATOR 2**



OSCILLATOR 2 is identical to OSCILLATOR 1 with one exception, the RING MOD switch featured in OSCILLATOR 1 is replaced with a SYNC switch in OSCILLATOR 2. For all other functions, you can refer to the explanation in the section above on OSCILLATOR 1.



When this switch is on, OSCILLATOR 2 is synchronized to OSCILLATOR 1. If you are unfamiliar with this effect, experiment with it by using the ASSIGNABLE CONTROL to apply heavy VIBRATO or ENVELOPE modulation to OSCILLATOR 2. This control is explained in a later paragraph.



This oscillator can be transposed as described in the section on OSCILLATOR 1. Additionally, if you press the TRANSPPOSE switches one after the other, the next two keyboard key presses will set the two oscillators.

### **SWEEP** SWEEP

The sweep generator generates repetitive low frequency shapes. The shapes can be either sinusoidal or square.



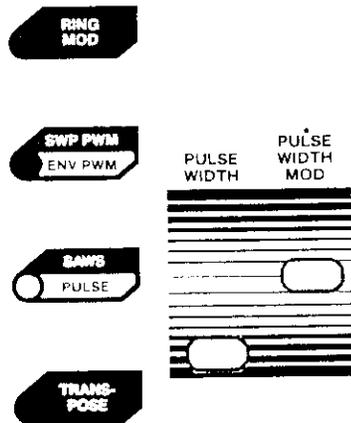
Sinusoidal mode. All six generators free-run asynchronously. The sine wave is used when vibrato, tremolo or slow sweeping effects are desired.



**NOISE**

This is a pink noise source that feeds into the filter. It can be turned on and off. If noise is desired by itself, the oscillators must be disabled by selecting the pulse shape and setting the pulse width to zero.

**OSCILLATOR 1**



This adjusts the amount of high frequency content in the final sound. Lowering the slider reduces the high frequencies, raising the slider increases the high frequencies.



This adjusts the resonance of the filter. When turned all the way up, the filter will oscillate. It can be used as an oscillator by itself by disabling the oscillators and setting the KYBD TRACK slider all the way up.



This adjusts the degree of delayed sweep modulation of the filter. If none is desired, set the slider in the middle. The modulation can be either positive or negative.

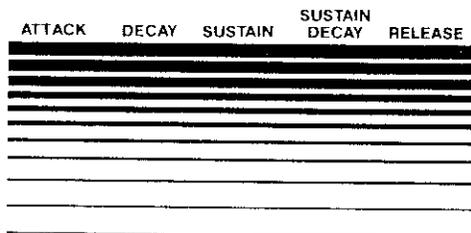


This adjusts the degree of envelope modulation of the filter. If none is desired, set the slider in the middle. The modulation can be either positive or negative.



This adjusts the degree to which the filter tracks the keyboard. If the filter tuning is to be independent of the keyboard, set the slider in the middle. If the filter is to precisely track the keyboard (as when it is used as an oscillator), push the slider all the way up. Pushing the slider up part way is the most generally useful part of the range. Pulling the slider down allows reverse tracking.

### ENVELOPE



### ENVELOPE

The ENVELOPE generates a shape to modify the timbre of each note over time. It is an ADSDR (Attack, Decay, Sustain, Sustain Decay, Release) type that can be used to modulate the pitch of OSCILLATOR 2, the pulse width of either oscillator, or the filter cutoff. A switch allows it to be made touch-sensitive.



When this switch is on, the envelope will be touch sensitive; the harder the keyboard is played, the more the envelope will be heard.

ATTACK



During the attack phase the sound rises to its peak value. It then switches to its decay phase. The slider adjusts the attack time from 0 to 10 seconds.

DECAY



This adjusts the rate at which the sound decays to the sustain level, and is adjustable from zero to infinity. When set to maximum, the envelope will remain at the peak level until the key is released.

SUSTAIN



This adjusts the level (as a percentage of the peak level) at which the initial decay stops and the sustain decay takes over.

SUSTAIN  
DECAY



This adjusts the rate at which the sound decays to zero after the sustain level has been reached. Pushing this slider all the way up prevents the sound from decaying below the sustain level.

RELEASE



When the note is released, the ENVELOPE is forced into its release phase. This sets the rate at which the envelope decays after the note has been released, and is adjustable from zero to infinity.

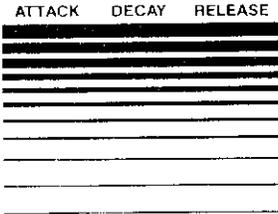
The two decays and the release can be set to infinity, if desired for drone effects. A conventional ADSR shape can be approximated by setting the sustain decay time to infinity.

# VOLUME ENVELOPE

## VOLUME ENVELOPE



This is an ADR type envelope that controls the volume only. A switch allows it to be made touch-sensitive. The decay and release can be set to infinity, which is useful for drone effects.



The way the volume of each note varies over time is controlled by the VOLUME ENVELOPE. It is simpler than the main ENVELOPE above.



When this switch is on, the volume envelope will be touch sensitive.



This adjusts the attack time from 0 to 10 seconds.

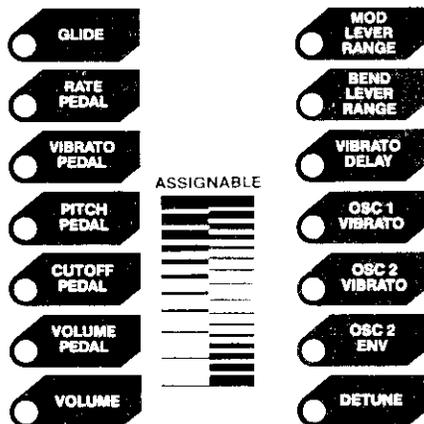


This adjusts the rate at which the volume decays to zero. If pushed all the way up, the volume will not decay while the keyboard key is held down.



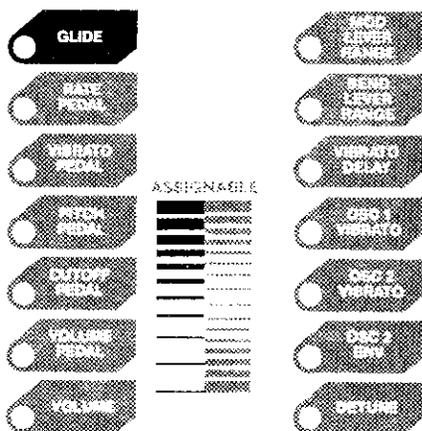
This adjusts the rate at which the volume decays after the note has been released. If pushed all the way up, notes will last indefinitely, and can only be stopped by pulling this slider down.

## ASSIGNABLE CONTROL

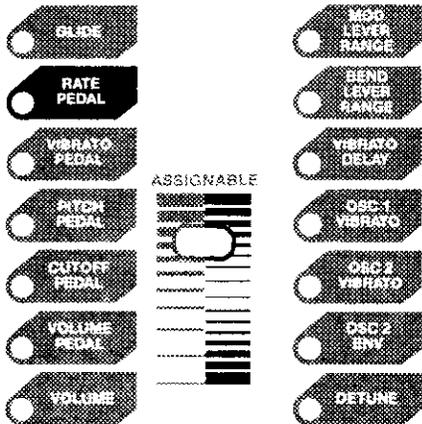


### ASSIGNABLE CONTROL

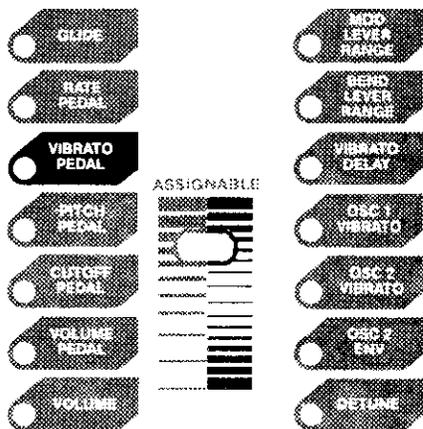
The slider in this section can be assigned to any of fourteen parameters. Pressing one of the fourteen switches in this section connects the slider to the corresponding parameter. This section contains both unipolar and bipolar parameters. The unipolar parameter switches are dark and the bipolar parameter switches are light.



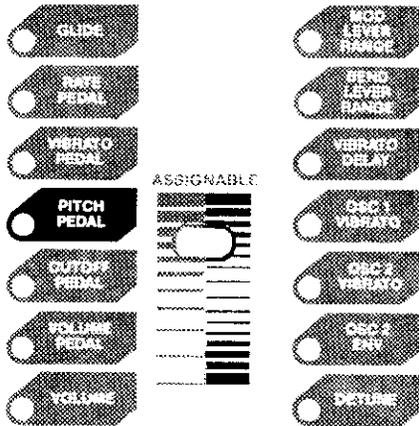
This adjusts the time for each oscillator to slide from note to note, and is adjustable from 0 to 10 seconds. In order to hear the glide, it is necessary to set this to a non-zero value AND press the sustain footswitch. While pressing the footswitch, the same channel will be used repeatedly for each note, resulting in a monophonic glide. As soon as the footswitch is released, the glide stops and the keyboard operates polyphonically again.



This adjusts the degree to which the pedal affects the sweep rate. To use this, adjust the sweep with the pedal in the heel position, then adjust this parameter with the pedal in the toe position. This is a unipolar parameter. The pedal can either speed up or slow down the sweep.

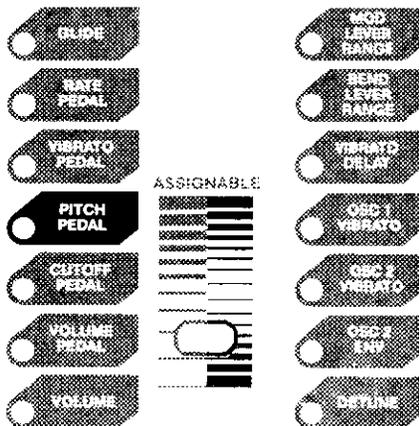


This adjusts the amount of vibrato (or trill) the pedal will apply to the two oscillators. This is a bipolar parameter, so the pitch the oscillators trill to can be either above or below the nominal pitch. This vibrato is not delayed.

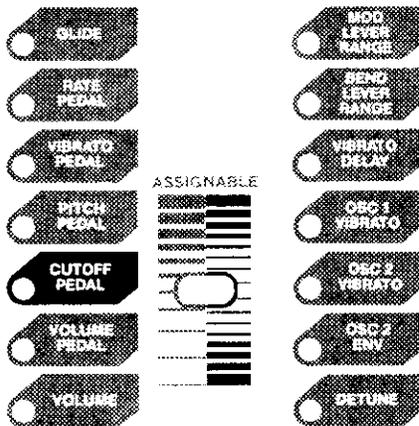


This adjusts the amount of pitch bend the pedal imparts to the two oscillators. This is a bipolar parameter, meaning the range is zero when the slider is centered. However, the two sides of the slider's range have somewhat different functions, as explained below.

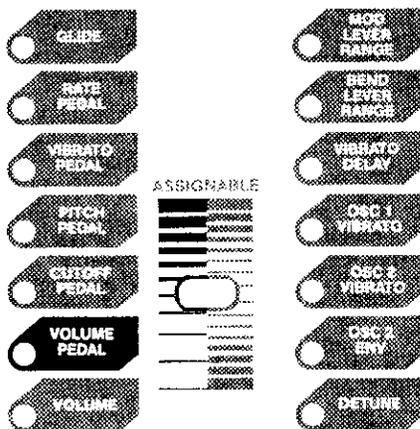
When the slider is pushed up, a normal pitch bend is obtained. Near the center the pitch bend is microtonal, while at the end the pitch bend covers an octave. Pushing the pedal down with your toe raises the pitch, while pulling it back returns the pitch to normal.



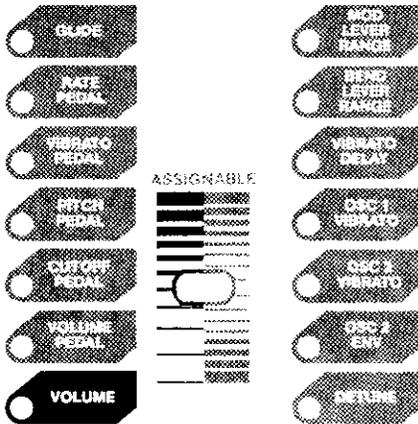
When the slider is pulled down, the polarity of the pitch bend remains the same, yet the Selective Pitch Bend feature is engaged. In this mode, the pitch bend only effects keys that are held down. If a note is held with the sustain footswitch and its key is released, its pitch bend "freezes" wherever it is. One can, for instance, play a chord, hold it with the sustain footswitch, release some of the keys, and then bend the notes belonging to the remaining held keys. This allows guitar and pedal steel effects previously impossible with a synthesizer. To adjust the range of this parameter, hold a note, push the pedal all the way forward and adjust this parameter for the desired pitch change.



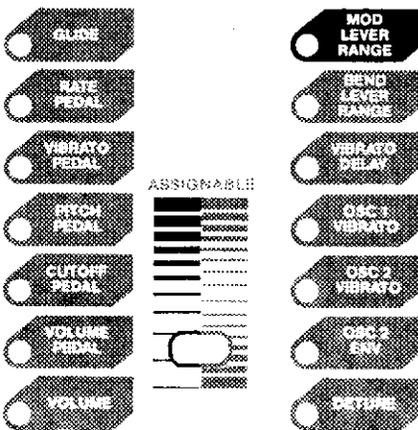
This adjusts the degree to which the pedal affects the FILTER cutoff. This is bipolar, allowing the pedal to either open the filter up or close it down.



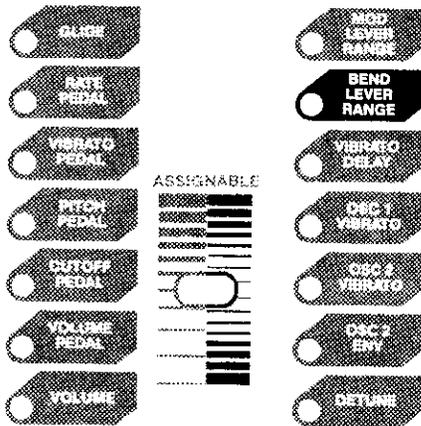
This adjusts the degree to which the pedal affects the volume. At its maximum, it allows the pedal to control the volume from full off to full on.



This maintains a volume balance between the various sounds and is particularly important when two sounds are linked together. For mellow sounds, this should be set at about three-quarters; brighter sounds should be set a bit lower. This can also be used to balance the "play-along" volume with the volume of a sequence. If there is no link set up, or no sequence running, it can be used to set the overall volume of the instrument. In general, however, overall volume adjustments should be made with the master volume control rather than the volume parameter.

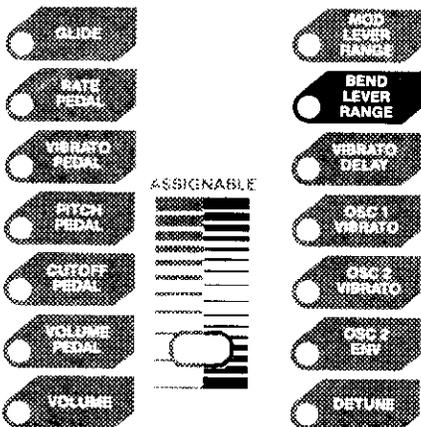


This adjusts the amount of vibrato (or trill) the Mod Lever (the leftmost lever to the left of the keyboard) imparts to the two oscillators. This vibrato is not delayed. To set, hold a note with the sustain footswitch, pull the Mod Lever all the way back (or forward) and adjust this parameter for the desired range.



This adjusts the amount of pitch bend that the Bend Lever (the rightmost lever to the left of the keyboard) imparts to the two oscillators. This is a bipolar parameter, meaning the range is zero when the slider is centered.

The upper part of the range results in a normal pitch bend. Near the center of the slider range, the pitch bend is microtonal, while at the end the bend range is one octave.

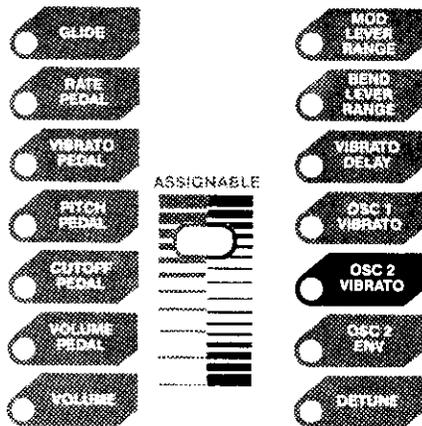


The lower part of the range engages the Polaris' exclusive Selective Pitch Bend feature. In this mode, only those notes held down are affected by the Pitch Bend Lever. If a note is held with the Sustain Footswitch, the Pitch bend "freezes" at the instant the key is released. Other keys that are still held continue to be affected by the pitch bend.

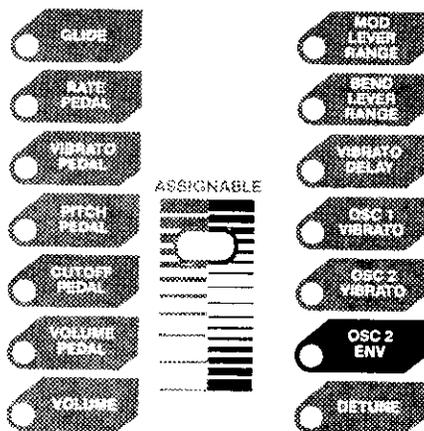
Pedal steel guitar effects can be obtained by playing a chord, holding it with the Sustain Footswitch, releasing the notes you don't want to bend, and then bending the held notes with the Pitch Bend Lever.

Another nice effect is to hold the Sustain Footswitch down and play several disconnected notes, bending each one while the previous notes remain constant.

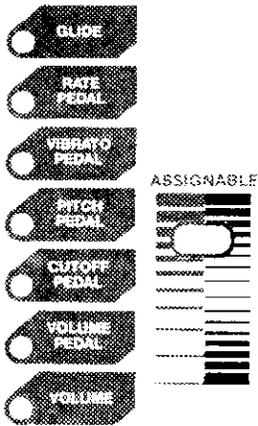
You can even bend two notes together by playing a note along with the note a whole tone below it, releasing the upper note (while holding it with the Sustain Footswitch) and then bending the lower note up.



This adjusts how much delayed vibrato is applied to OSCILLATOR 2. It is a bipolar parameter, and is separate from OSCILLATOR 1's vibrato so that the two oscillators can be modulated separately, perhaps in opposite directions. Pulling the slider all the way down, though, causes OSCILLATOR 2's vibrato to come from OSCILLATOR 1, for ease of adjustment when independent vibrato is not needed.

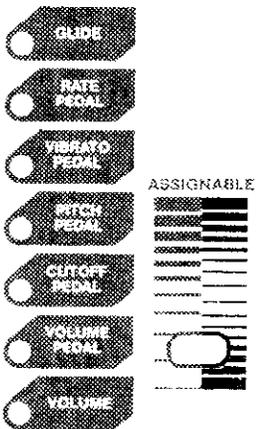


This adjusts how much the envelope modulates the pitch of OSCILLATOR 2. This is primarily useful when sync is on. It is a bipolar parameter with very fine gradations around zero so the envelope can be used for dynamic detuning, and larger gradations toward either end for a wide control range.



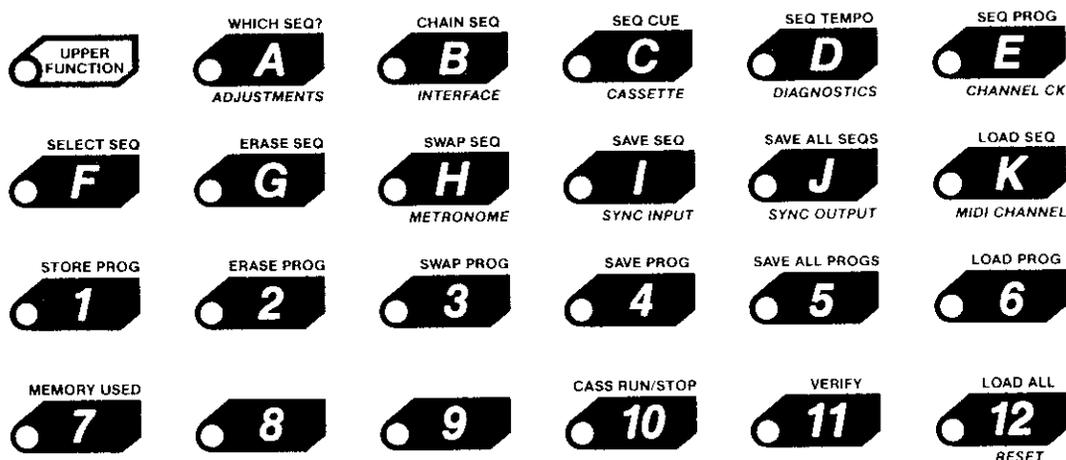
This tunes OSCILLATOR 2 up to a semitone sharp. Detuning is off when this is in the center.

Pushing the slider up results in an even detuning across the entire keyboard. This can present a problem if you are not expecting it, since the "right" amount of detuning in the lower octaves will be the "wrong" amount of detuning in the upper octaves, and vice versa.



Pulling the slider down detunes the oscillator sharp with a skewed detuning that gives a constant beat frequency across the keyboard. The result is an even-sounding detuning in all ranges of the keyboard. You can use any note or keyboard range to adjust the desired tuning. We suggest this type of detuning for chorus, phase shifting, and flanging effects.

## BANK SELECT/PROGRAM SELECT



### BANK SELECT/PROGRAM SELECT

The primary purpose of the switches in this section is to select among the 132 sound programs stored in the instrument. These programs are organized as eleven banks of twelve programs each.

The number switches are also used to identify one of twelve sequences the instrument can hold. In addition, the letter and number switches have secondary functions for managing the Polaris' internal memory, saving and loading data with a cassette, etc. Detailed information on all of these functions can be found in later chapters.

### The Mod and Bend Levers

The left lever is dedicated to controlling the amount of sweep modulation (vibrato or trill) applied to the oscillators. Its depth is adjustable in both directions. The sweep signal applied through the Mod Lever to the oscillators is not delayed.

The right lever is dedicated to the pitch bend function. Its depth is adjustable via the ASSIGNABLE CONTROL. It can be set up as a normal pitch bend or as a Selective Pitch Bend, as described in the ASSIGNABLE CONTROL section above.

### The Keyboard

The keyboard is of course the main source of pitch information to the oscillators. Changes from note to note can be instantaneous, or can be slurred by the GLIDE. The keyboard pitch can also be used to modulate the filter cutoff, and the depth of this modulation is

adjustable over a wide range, allowing no tracking, unison tracking, undertracking and reverse tracking. The range of the keyboard can also be extended.

The keyboard can be made to seem an octave longer with the range switch. When illuminated, the notes of the keyboard are transposed one octave higher. Notes sounding before the switch is pressed are not effected. To experiment with this, play and hold a chord with the Sustain Pedal. Then press the KYBD RANGE switch, and play on top of the chord you are holding. You will hear that the same keyboard keys you used to play your chord will sound an octave higher when the KYBD RANGE switch is on.

The Pedal (optional)

The foot pedal puts out a unipolar signal that can modulate pitch, filter cutoff, volume, vibrato depth, and sweep rate into the oscillators, all with adjustable depths. As with the Mod Lever, the sweep signal applied through the pedal to the oscillators is not delayed. This pedal is available from your Polaris dealer.

## CHAPTER 5/POLARIS TUTORIAL

### TUTORIAL

The Polaris can produce almost any type of sound. Once you have created a sound, you may save it in the Polaris' memory and recall it at any time. The Polaris comes with many stored sounds (or "programs") that you can call up and listen to immediately. As you become familiar with these programs you will begin to understand the special capabilities of the Polaris. You can also use these stored sounds as starting points for creating your own sounds.

To call up a program press any letter switch (A-K). The numbers that light up are all recorded programs. Your Polaris comes with 132 stored programs, so all the number switches (1-12) in all the banks (A-K) should light up. Press any number switch (1-12) you want, and play away. A list of all the stored sounds is in Chapter 16.

Possibly the most difficult concept to grasp when learning the Polaris involves slider positioning when a program is called up. If you don't already have a program called up, call one up now. What you are actually doing is copying a program from storage into the workspace, so the original stays in storage and the duplicate is what we work on.

Notice that it doesn't matter where the switches and sliders are set because the Polaris automatically resets them internally to match the programs you call up. If you stop and think for a moment, it has to be this way. The Polaris can't physically move each slider to the pre-set location whenever you change programs (although it does reset the switches, have you noticed?). Therefore, it must "mentally" reset them.

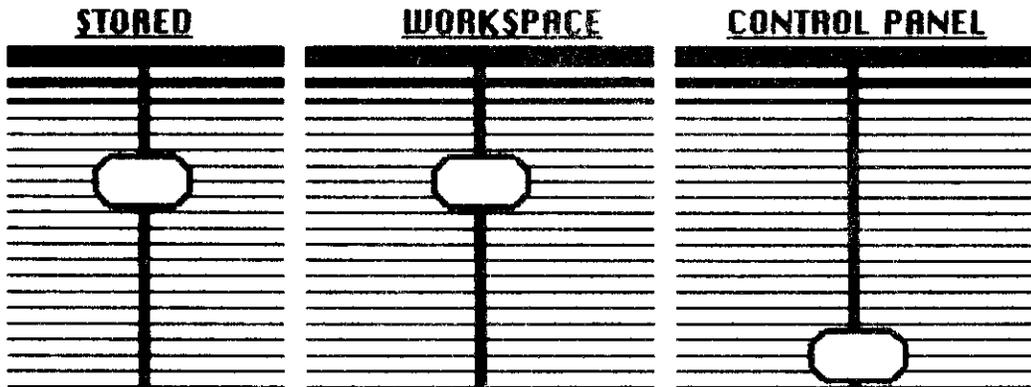
If you wish to change the sound of the program in the workspace, you may of course do so. As soon as you move any of the sliders or change any of the switches, the Polaris immediately accepts the new value and changes the sound of the program.

Unfortunately, this doesn't make it very easy for us humans to see what the patch is. However, after a few days of working with the Polaris (if that long), you will become familiar enough with it that you won't even notice. We'll use what we call the "ears on" technique to illustrate this concept and to help you determine how each slider affects the overall sound.

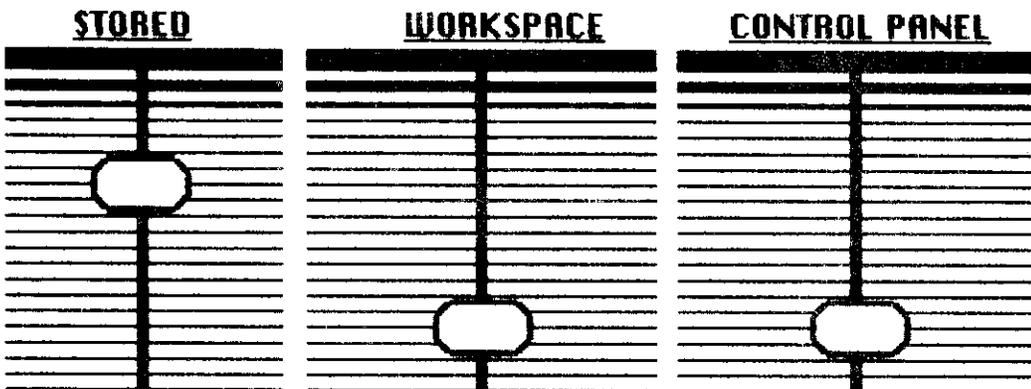
The slider we are going to use is the FILTER CUTOFF slider. This slider controls the timbre by controlling the harmonics. It is called a cutoff slider because it cuts off the higher frequencies as it is moved down from the full up position (it is also known as an adjustable low pass filter). As you move the slider up and down, notice how the sound changes from bright to dark.

Set the FILTER CUTOFF slider to zero and call up a program. Notice that the program sounds normal even though the FILTER CUTOFF slider is off. This is because the version of the program you just copied into the workspace was stored with the FILTER CUTOFF slider towards the

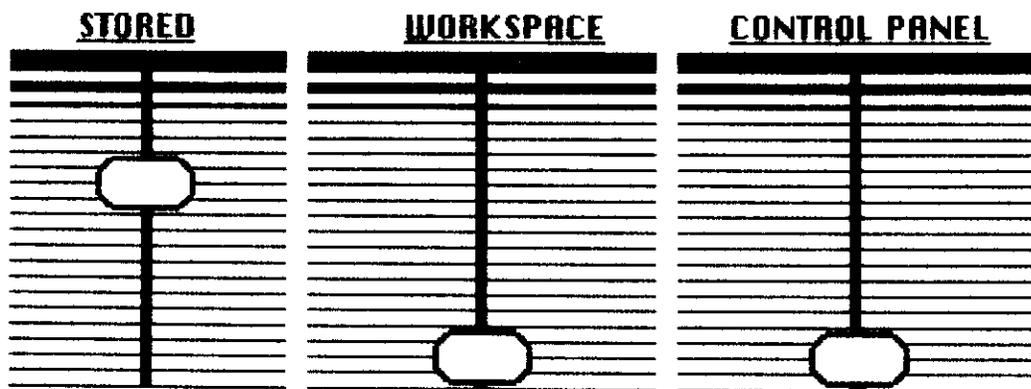
middle of the range. The stored value and the workspace value of the FILTER CUTOFF slider are the same, and the control panel value of the FILTER CUTOFF slider is irrelevant.



Now, move the FILTER CUTOFF slider up slowly until the sound changes. At this point, the Polaris has recognized the change, and has replaced the previous (workspace) value with the new (control panel) value.



Even if you return the slider to the position it started in, you will not hear the sound you started with before you moved it.



This might seem obvious when dealing with the FILTER CUTOFF slider, but unless you fully understand this point, you will be baffled when a small movement of one of the sliders completely changes a sound, and you can't regain the sound you remember by returning the slider to the position in which you first found it.

Now that you are on the brink of understanding slider positions, let's try some ear training. Call up a program again. What we want to do is to go across the control panel changing one slider at a time and listening to the difference each change makes. Once you hear the difference, the trick is to duplicate the original sound by setting the slider in the proper position.

If you have any doubts about this exercise, start out slowly. Experiment first with the FILTER CUTOFF slider, and simply match the timbre of the program in the workspace with the timbre of the program in storage. When you are sure the two are the same, press the PROGRAM SELECT number switch again to call the same program out of memory, and compare your version with the Polaris'. Once you have mastered this, go on to the PULSE WIDTH slider in the OSCILLATOR 1 section.

While you are playing with the sliders in the various sections, don't be afraid to experiment with the switches, too. For example, the switch in the MASTER section may also be used for tuning the instrument. Another arrangement you might try involves the PULSE

WIDTH sliders in both oscillator sections. To set up for this experiment, first move both PULSE WIDTH sliders throughout their full range, and then set them to the center position. From the center position, move one slider up until you hear a change in the sound. Then move the other one up until the sound just changes. Notice the difference? Now, return them both to the center position and repeat this experiment, only this time move one up and the other one down.

The most radical changes in timbre will occur when you move the sliders in the FILTER section, as you know from experimenting with the FILTER CUTOFF. It is one of the most powerful sections on the Polaris, and once you understand its nuances you will be able to create some incredible sounds at will.

RESONANCE - Most musical instruments (and even some electronic circuits) have the tendency to vibrate more freely at some frequencies than at others. The point at which they vibrate the most freely is their resonant frequency. Because they vibrate more easily at this frequency, they are louder at this frequency than at any other. The RESONANCE slider allows you to make use of this effect. When the RESONANCE slider is towards the top of its travel, it is driven into self-oscillation due to the amount of gain in the circuit. Also, the sound gets thinner as you approach self-oscillation.

SWEEP DEPTH - This determines the amount of affect the SWEEP section is going to have on the sound. Set the filter CUTOFF to about three-quarters up and set the SWEEP DEPTH slider either up or down. Listen to the difference between SINE and SQUARE waves as you vary the RATE slider.

ENV DEPTH - This determines the amount of effect the ENVELOPE section is going to have on the sound. Experiment with the DECAY slider all the way up. Move the ENV DEPTH slider up and down.

KYBD TRACK - This helps you to imitate many acoustic instruments that become brighter and louder when higher notes are played on them. In the center position, this slider has no affect. In the up position, the sound gets brighter as the notes go higher, and in the down position it's just the opposite. You can also use this to balance linked sounds.

If you finish this exercise and you start to feel more confident, call up some of the other programs and do the exercise with them with them. As you become more fluent with the Polaris, you will find that you can observe more about the control panel without becoming flustered. When you call up the programmed sounds, make note of the switch settings; see which switches are on and which are off. Be particularly observant of the switch settings in the KYBD section. If the LINK UPPER or LINK LOWER switches are on, be sure you play the entire keyboard to see what two sounds are at work.

This exercise is good not only for becoming familiar with the Polaris, it is also good practice for the time when you will need to re-create the slider settings for a stored sound.

### Imitating Acoustic Instruments

There are several factors to consider in imitating acoustic instruments. Different instruments have different ranges of pitches they can play. If you are trying to imitate a violin, make sure you are playing notes in the normal violin range or it will never sound natural. It is common to have part of the keyboard sounding very close to the live instrument and another part sounding wrong (a good time to split the keyboard). Also try to play phrases that would actually be played on the instrument you are imitating. Don't despair if your creation doesn't sound 100% right. When mixed in with other instruments (or played as lead on top of a sequence) it will sound more natural.

A note played by an acoustic instrument is composed of many parts. The frequency we identify as the unique pitch of a tone is actually only one of many frequencies sounding together in a relationship called the harmonic series. Some of these harmonics are out of the normal range of hearing but if they are eliminated, the sound will lose some of its character. For example, if the high frequency tone control is turned all the way down on a radio, it becomes difficult to distinguish a violin from a clarinet or flute. In the Polaris, the filter and the pulse width sliders allow you to control the harmonic content of the sound.

Strings, brass, winds, and the vowel sounds of the human voice are all rich in harmonic content. Sawtooth waves contain all harmonics, both odd and even. It is ideal for synthesizing acoustic instruments of many types. An unmodified sawtooth wave is a rich combination of string- and brass-like sounds. By filtering out the higher harmonics, you can imitate a flute, and by filtering out the fundamental and using the 2nd harmonic as a source, you can create an oboe sound.

You will probably develop your own procedure for creating sounds. For example, after setting the basic waveform, you might next set the CUTOFF and the RESONANCE sliders to get the sound into the ballpark, and then fine-tune from there. Remember, if you ever become completely lost when creating a sound, you can always easily start over by pressing a switch in the PROGRAM SELECT section to get another sound.

One way to create your own sounds (and programs) is to begin from a familiar starting point. This can either be one of programs already in the Polaris, or you can make what is called a scratch program. A scratch program is nothing more than the default settings for all the parameters.

Since the Polaris comes with all memory locations programmed, you will have to erase a program you don't like to get a scratch sound. (Before you do this, you will probably want to check out Chapter 9 to find out how to get the program back after you have erased it.) To erase a program, press UPPER FUNCTION, ERASE PROGRAM, A-K, 1-12. You can tell if you have erased a program because its LED will not light up when its Bank Select switch is pressed. The sound you hear when you select an unlit program switch is the scratch program.

#### Some Hints

FLUTE - Start with the scratch sound. Filter out the high frequencies by moving the cutoff slider down very slightly until the volume of the sound drops off. Then raise the RESONANCE slider just a hair. Move the KYBD TRACK slider to the top and soften the ATTACK in the VOLUME ENVELOPE. Sweeten with a little vibrato. Make sure the SWEEP is on sine wave. Move the sweep control up to about 3/4 maximum, then raise the sweep depth slider until you hear a subtle vibrato (not too fast - control speed with RATE). You can "fine tune" the sound by adjusting those same controls. Use VIBRATO DELAY on the ASSIGNABLE CONTROL to increase the delay before vibrato starts to add authenticity. When you have the basic sound where you want it, try adding a LINK UNISON with a touch-sensitive noise program to duplicate the breath sounds.

OBOE - Starting with the scratch sound, slowly move the PULSE WIDTH lever on OSCILLATOR 1 up until the sound changes (becomes a bit muted). Do the same with the PULSE WIDTH lever on OSCILLATOR 2 until you hear only one tone that is an octave higher than the main scratch tone. This is the 2nd harmonic. Move the FILTER CUTOFF lever up until a brighter more nasal oboe-like sound is heard. Drop the RESONANCE control to darken the sound. You should be able to hear the basic oboe sound already. Add vibrato and you have it.

CLARINET - An exception to the rule of using sawtooth waves for live instruments. Start with the pulse wave. Pulse waves are made up only of odd-numbered harmonics.

BRASS - All instruments produce some noise, mostly on the attack of a note. Try creating a noise program to get extreme transients on a keystroke and do a LINK UNISON to another program with a basic brass sound. You can experiment by turning off one oscillator to minimize unexpected interaction of voltages. Use the sawtooth waveform.

PERCUSSION - Strong attacks and noise are the key elements.

OTHER SOUNDS - To get noise without tones, select the pulse waveform and set the PULSE WIDTH slider to either extreme for both oscillators. Turn on the noise and modify. Sirens may be easily produced by selecting OSC 1 VIBRATO in the ASSIGNABLE CONTROL section, and putting

the slider all the way up. Also set the sweep rate all the way down (the slowest position) with a sine wave sweep.

ALL - Once a good basic sound is obtained by filtering and modifying the envelope, try enhancing with the ASSIGNABLE CONTROL. The Mod Lever on the far left of the keyboard is extremely useful for simulating the increase in intensity in a note held for a long time. The Bend Lever allows you to simulate glides and glissandos --- even pedal steel effects. When you are getting close to the sound you want, work slowly, as even small movements in the sliders can change the sound drastically. Also, when you have created a sound you like, SAVE IT. Some sounds might take you hours to get just right, so don't risk losing them!

On the subject of saving your programs, we would like to recommend that you buy an inexpensive cassette tape recorder and USE it. You probably noticed when you unpacked your Polaris that it came with a back-up tape. Let this tape be the first in your library of tapes of programs and sequences, so you need never complain of losing something special. For further information on using a cassette recorder, see Chapter 9.

To go through all the sounds the Polaris can make step-by-step would take a fairly large book. The important things to remember are to use your ears and to be aware of all the possibilities the Polaris offers you. The Polaris has the power to do any of a vast array of sounds, so the most common limiting factor is going to be the person using it. If you ever find yourself saying, "I wish I could do ... on the Polaris," you probably already can: You just have to keep stretching yourself to discover how.



## CHAPTER 6/MANIPULATING PROGRAMS

### PROGRAM MANIPULATION

#### Upper and Lower Functions

The Polaris includes extensive facilities for manipulating entire sets of parameters, or programs. Most of these functions involve pressing multiple switch sequences. On the Polaris there are switches with labels either above the switch, below the switch, or both. These labels describe functions accessible with multiple switch sequences. Functions with labels above the switch are called Upper Functions, and those with labels below the switch are called Lower Functions. There are two switches on the Polaris with the sole purpose of accessing these Upper and Lower Functions.

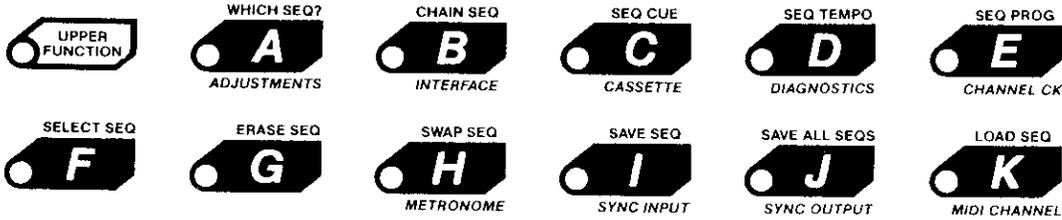
NOTE: If the UPPER FUNCTION or LOWER FUNCTION switches have been engaged, you won't be able to control the sequencer or select programs until they have been turned off.

#### Combining Switches

After you press either switch it will flash, indicating further action is necessary to complete the selection. If pressing only one other switch will complete the selection, the desired function will be performed and the LED will stop flashing. If more than one switch is required to complete the selection, the second switch will start flashing after it is pressed, and the Upper or Lower function switch will turn on steadily.

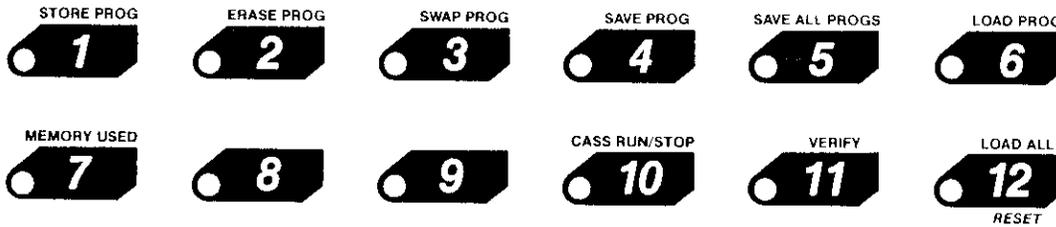
#### Cancelling a selection

A multiple switch sequence does not take affect until the last switch is pressed. This means you can abort a selection at any time before the last switch is pressed without changing the present parameters. You may cancel a Lower Function sequence at any time by pressing the LOWER FUNCTION switch again. You may cancel an Upper Function sequence by pressing the UPPER FUNCTION switch a second time.



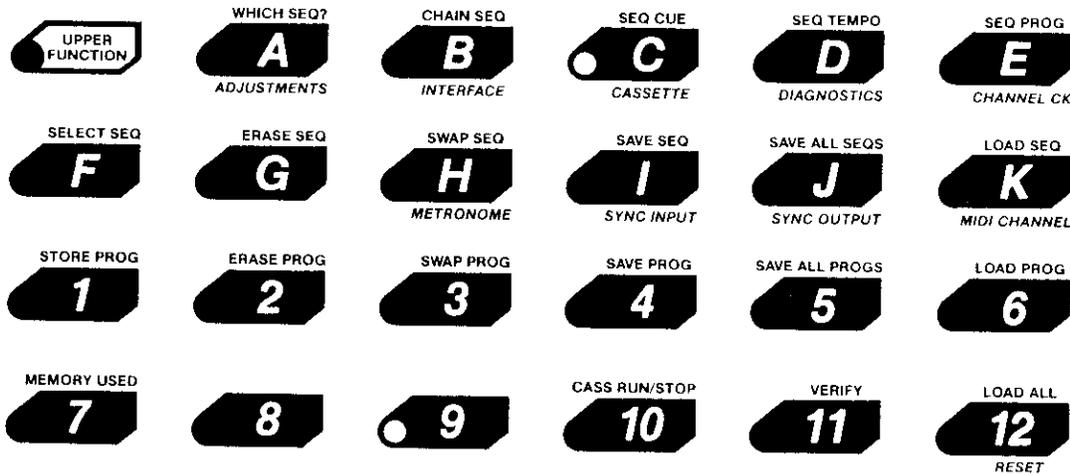
### Program Status Display

At any time, one of these switches will be lit, indicating the selected bank.



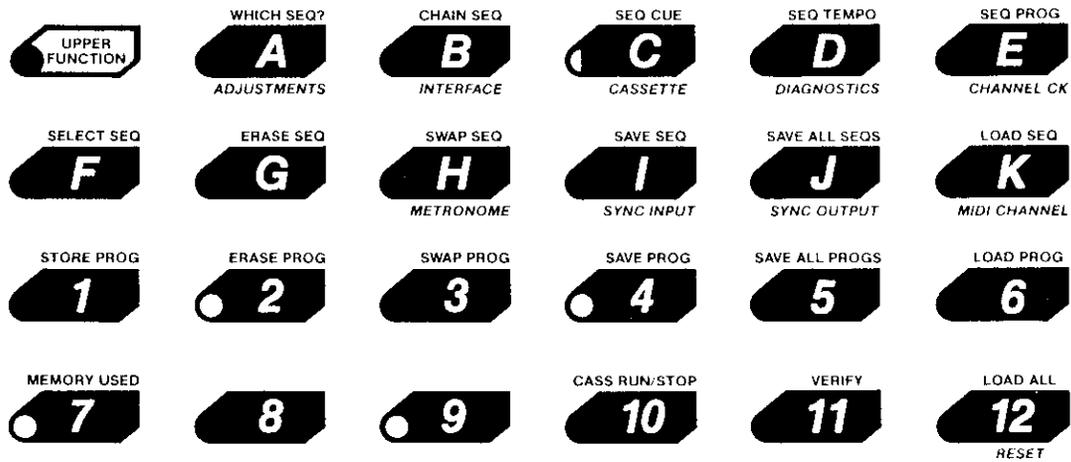
One of these switches also will be lit, indicating the selected program within the bank.

### BANK SELECT/PROGRAM SELECT



Most of the time, a single bank (letter) switch and a single program (number) switch will be turned on. The combination of the two indicates which program most recently selected. In this illustration, the program residing at C9 has been selected.

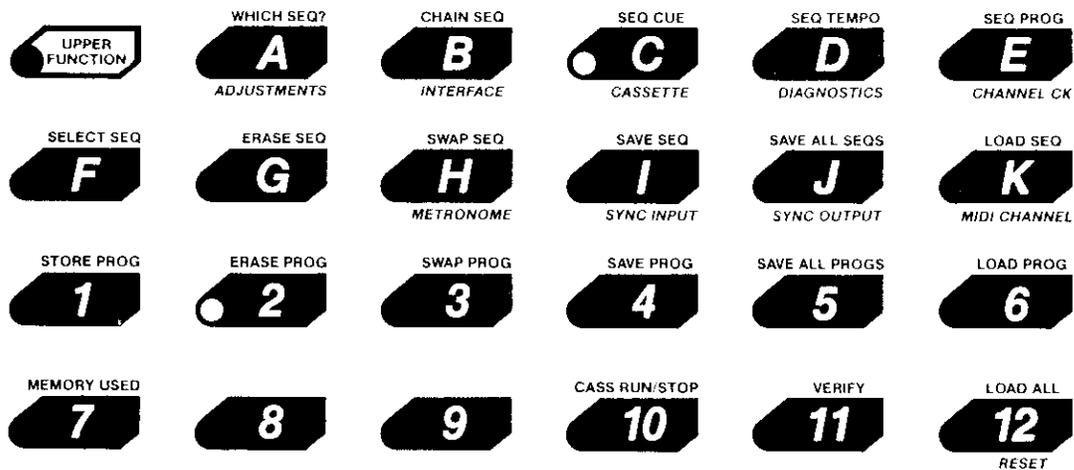
## BANK SELECT/PROGRAM SELECT



### Viewing One Bank's Programs

Pressing the letter switch of the currently selected bank reveals all programs stored in that bank, and the bank switch will flash.

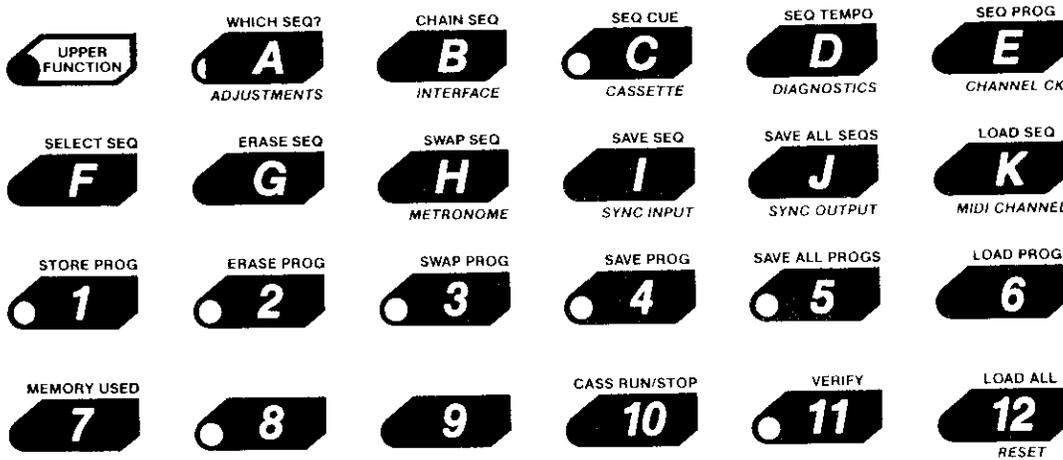
## BANK SELECT/PROGRAM SELECT



### Changing Programs Within a Bank

Pressing another number immediately selects a new sound from the current bank.

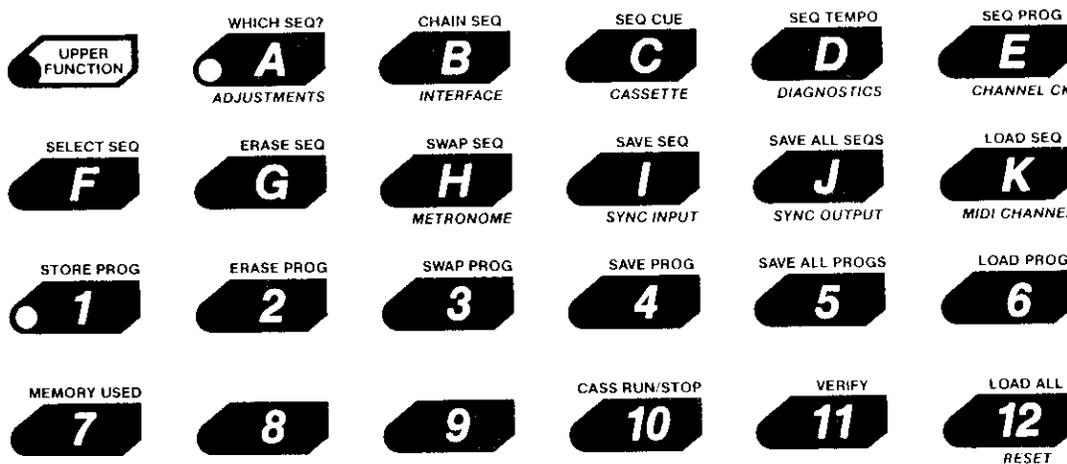
## BANK SELECT/PROGRAM SELECT



### Previewing Other Bank's Programs

Pressing a letter not currently lit causes it to flash, indicating the Polaris expects you to press a number switch next. If there are any programs stored in the new bank you have selected, the switches where they are stored will light up. If you change your mind, pressing the flashing letter switch again cancels your choice.

## BANK SELECT/PROGRAM SELECT



### Selecting a Program from Another Bank

Pressing a number switch selects a new sound from the bank you chose, and illuminates both switches to show your current status.

### The Main Workspace

When you select a program, you are actually copying it into an area called the main workspace. The sound you hear is controlled by this copy, not by the original. All changes you make to the sound by adjusting parameters are made to the copy and not to the original, so you may experiment freely without fear of corrupting the original. Don't be afraid to modify your programs. If you hear something you don't like, change it until you do like it. Remember that until you store the program, you are only experimenting. Also remember that if you modify a program you must store it in one of the 132 slots if you wish to save it for later recall. If you modify a program and then switch to another program without saving it, the modified program is lost.

NOTE: Even though the Polaris is a very sophisticated instrument, and can appear imposing at times, don't forget that its purpose is to make sounds. Don't forget that your ears are the boss, not this manual, not your brain, not your eyes. This is especially important to keep in mind when you call up a program and begin to modify it. When a program is called up, it plays back the way the switches and sliders were set when it was recorded. It will continue to play that way until you move a slider or press a switch, then it will take the new value of the slider or switch you have changed.

For example, if you set all the sliders to their off positions and call up a program, you will hear a sound. If you move one of the sliders a little bit, the sound will remain the same EXCEPT for the slider you have just moved. Now, if you return that same slider to the zero position it started at, the value of that slider will be zero, and NOT what the program had set it to. If you stop using your ears and start using your eyes, you will have a difficult time understanding this. To return to the sound as the program originally set it, move the slider until the sound you hear matches the sound you remember.

If this is unclear to you, try setting all the sliders to zero and calling up a program. A few minutes' experimentation and listening should make this point clear.

### The Scratch Program

Just because the Polaris can hold 132 programs does not mean there are in fact that many in its memory at a given time. If you select a particular program that does not exist, you are given a "scratch" program to start with. You may either select another program if you are looking for existing sounds in the memory, or you may use this scratch program as a starting place for creating a new sound.

### Program Storing

The current program, including any changes made to it, may be saved for future recall. All parameters, including the miscellaneous parameters (keyboard split, etc) are saved as well. Programs can be stored either in the currently selected bank or in any other bank.



This stores a program in the currently selected bank.



This stores a program in another bank.

You can press many letter switches before pressing a number switch and only the last will be in effect. The program isn't actually stored until you press a number switch. Before this point, you may change your mind and not store the program by pressing UPPER FUNCTION again.

When you store a program, you should keep in mind the settings of the miscellaneous parameters. For instance, if the pedal is used in the sound, remember to store the sound with the optional pedal in the on position, as the sound will be recalled the same way when the program is later selected. This is a way to get non-delayed oscillator vibrato and delayed filter/pulse width modulation. Also, be aware of the parameter selected in the ASSIGNABLE CONTROL section; try to select something useful in this section before storing the program.

### Program Swapping

The current program can be swapped with any of the stored programs. This is useful if you want to compare an edited version of a sound with the original. Simply swap back and forth listening to the two sounds until you've decided which you like better. Remember, though, the one you are hearing is the one that ISN'T stored!



This sequence swaps the workspace program with another program in the same bank.



This sequence swaps the workspace program with another program in a different bank.

The swap operation doesn't occur until you press the number switch to define the exact program you wish to swap with, and can be aborted by pressing UPPER FUNCTION a second time.

If you swap a program with a non-existent program, you will hear the scratch program. If you then swap it back, you will have stored a COPY of the scratch program in memory, so that program now exists and takes up space.

### Program Erasing

The Polaris' memory is used to hold both programs and sequences. If you wish to make more room for sequences, you may do so by erasing programs. Each program uses about as much memory as eight notes, so erasing a single program is not all that useful. However, the space occupied by all 132 programs can hold over 1000 notes, so this function is useful when used to erase larger numbers of programs. Since the Polaris comes with a cassette with all the original data recorded on it, you can erase voice programs for additional sequencer memory and still be able to re-load the programs when you need them later. Don't be afraid to use the cassette.



This sequence erases a program in the current bank.



This sequence erases a program in another bank.

Erasing a program does not affect the current sound, even if you erase the program of which the current sound is a copy. Erasing a non-existent program does nothing. The erase operation doesn't occur until you press the number switch to define the program you wish to erase, and can be aborted by pressing UPPER FUNCTION a second time.

#### Miscellaneous Parameters

There are several other "parameters" not part of the description of a sound stored as part of each program.

**SLIDER ASSIGNMENT.** Whichever parameter is connected to the ASSIGNABLE CONTROL slider is remembered whenever a program is stored. Whenever the program is recalled, this same parameter will automatically be reconnected to the slider. If the ASSIGNABLE CONTROL is set to a parameter not to your liking, just re-assign the control and re-store the program.

**KEYBOARD SPLIT.** When linking two sounds together in LINK LOWER or LINK UPPER mode, the keyboard is split into two sections. The point at which it is split is saved along with all the other parameters whenever a program is stored. It has no effect unless Link Lower or Link Upper mode is in effect.

**KEYBOARD RANGE.** The setting of the KYBD RANGE switch is stored as part of a program. When turned on, this parameter causes further notes played to be transposed up an octave. Notes already sounding are unaffected.

**LINK MODE.** There are four possible link modes: No Link, Link Lower, Link Unison and Link Upper. The current mode is remembered whenever a program is stored, and automatically selected when the program is recalled.

LINK PROGRAM BANK AND NUMBER. When a link is established to a second sound, a particular program number and bank is specified. This number is remembered as part of the main program so when the main program is later recalled the correct secondary program will be linked to, as long as it exists in the same location as it did when the main program was stored.

INITIAL PEDAL POSITION. When a program is stored, the position of the pedal is memorized (if an optional pedal is connected). When the program is later selected, the sound is set up as though the pedal were in this same position. For example, a sound using the pedal to control its volume should be stored with the pedal forward so the sound can be heard. When the sound is later selected, it will still be heard, even if the pedal is now physically all the way back. As soon as the pedal is actually moved, it functions normally.



## CHAPTER 7/LINKING PROGRAMS

### PROGRAM LINKING

The performer can play two sounds at a time on the Polaris' keyboard. This is done by linking two sounds together. The link between two programs consists of three pieces of information.

Link Mode. This tells whether or not a link exists and, if it does, what kind of link it is.

Link Program Bank and Number. This tells what program is linked to.

Keyboard Split. This tells the point at which the keyboard is split.

These pieces of information are in fact parameters in a program. As such, they behave like any other parameter. They may be altered temporarily at any time, or their settings may be stored as part of the program. If a link is in effect when a program is stored, the same link will be set up again whenever that program is selected.

NOTE: When you recall a program with a link only the above three pieces of information are recalled. If the program specified by the Link Program Bank and Number has been changed since the link was stored, the link will be to the new program, as the old one no longer exists in that location. If you decide to link B, 4 with F, 8 and store this link in B, 4, the Polaris will remember all the voice parameters for B, 4, but it will only "look" to F, 8 to see what sound is there. If you have eliminated F, 8 to make room for more sequence storage, you have lost that part of the link and you will hear scratch program. If you rearrange programs in memory using the SWAP PROG function or the Cassette Interface, the links in these programs will likely not make sense, and will have to be redone.

#### The Three Link Modes

There are three different kinds of link mode:

Link Unison. In this mode, the keyboard is not split. Each key pressed causes both the main and the link sound to be heard.

NOTE: In the Link Unison mode the Polaris is only capable of playing three notes, since the six synthesizer channels are played two at a time.

Link Lower. In this mode, the keyboard is split. The link sound is heard below the split and the main sound is heard above the split.

Link Upper. In this mode, the keyboard is split. The link sound is heard above the split and the main sound is heard below the split.

NOTE: In the Link Upper or Link Lower modes, an exclusive Polaris feature called "Dynamic Voice Allocation" allows you to play any combination of notes on either side of the split point as long as the total does not exceed six.

EXAMPLE:	BASS NOTES PLAYED	CHORD NOTES PLAYED
	1	5
	2	4
	3	3
	6	0

You can, however, play bass notes "between" the chord notes (and vice versa), and get the full six voices playing on both sides of the split, at alternate times.

When a link is in effect, the KYBD RANGE parameter controls the transposition of the keys playing the main program. Of course, there is also a KYBD RANGE parameter in the link program. As one might expect, this parameter controls the transposition of the keys playing the link program.

#### Setting Up a Link Lower

LINK LOWER, 1-12

This sets up a Link Lower with a program in the current bank.

LINK LOWER, A-K, 1-12

This creates a Link Lower with a program in another bank. The link is not established until the number is pressed, and the operation can be aborted by pressing LOWER FUNCTION a second time.

#### Setting Up a Link Unison

LINK UNISON, 1-12

This sets up a Link Unison with a program in the current bank.

LINK UNISON, A-K, 1-12

This creates a Link Unison with a program in another bank. The link is not established until the number is pressed, and the operation can be aborted by pressing LOWER FUNCTION a second time.

#### Setting Up a Link Upper

LINK UPPER, 1-12

This sets up a Link Upper with a program in the current bank.

LINK UPPER, A-K, 1-12

This creates a Link Upper with a program in another bank. The link is not established until the number is pressed, and the operation can be aborted by pressing LOWER FUNCTION a second time.

#### Clearing a Link

To unlink, press LOWER FUNCTION, NO LINK.

#### Reestablishing a Link, Changing a Link Mode

To invoke a link without specifying the program number, press one of the three link switches twice. If no link is in effect, the program linked to will be the one specified by the Link Program Number parameter in the current program, which is the program it was most recently linked to. If a link is already in effect, only the Link

Mode is changed.

NOTE: The default settings for the scratch program are as follows: the link is with program A, 1, and the keyboard split is C below middle C. If a program has never been linked to, LINK LOWER, LINK LOWER will establish a link to program A, 1, with the keyboard split one octave below middle C, as will LINK UPPER, LINK UPPER, or LINK UNISON, LINK UNISON. Otherwise, the link will be established to the last program linked to.

#### Setting the Keyboard Split

LOWER FUNCTION, KYBD SPLIT, and press a key on the keyboard. This establishes the location of the keyboard split. The note will not sound. This key becomes the lowest note in the upper part of the keyboard. If you do this when no link is in effect or while in Link Unison mode, it will have no immediate effect but it will be remembered, and will take effect if you enter Link Lower or Link Upper mode. Remember, the actual split is in the crack below the key that you press.

#### Editing the Link

When a link is set up, the link program is copied into a workspace called the link workspace, and the link sound is controlled by the copy, not the original. You can, if you wish, modify the link sound by editing the program contained in the link workspace. This is done by pressing LOWER FUNCTION, EDIT LINK. You will note that all the programming parameter switches, as well as the KYBD RANGE switch, now show what their settings are in the link program. Manipulating any of these switches or any of the sliders will now affect the link sound. This effect is temporary, and does not affect the stored version in memory of the program linked to. When you are done editing the link, press LOWER FUNCTION again to return panel control to the main sound.

While in the Edit Link mode, you will notice that the letter and number switches now show what program is linked to. This is for your information only. You cannot "select" a new link by pressing a number switch.

#### Storing an Edited Link

If you have edited the link sound using the EDIT LINK function, you may wish to store the edited version.

#### LOWER FUNCTION, STORE LINK, STORE LINK

This stores the contents of the link workspace in the same memory slot it originally came from.

#### LOWER FUNCTION, STORE LINK, 1-12.

This stores the link workspace in a specific slot in the currently selected bank. This bank also contains the main program.

#### LOWER FUNCTION, STORE LINK, A-K, 1-12

This stores the link workspace anywhere else you might want it. In the last two cases, the Link Program number parameter in the main program will be changed. As usual, this operation can be aborted by pressing LOWER FUNCTION again.

## CHAPTER 8/THE SEQUENCER

### THE SEQUENCER

The sequencer is a single-track polyphonic real-time sequencer that can access any one of twelve sequences stored in the instrument. It includes a metronome whose tempo is controlled primarily by tapping the beat on the Sequencer Footswitch.

**SEQUENCER** The sequencer can be thought of as three pieces of information: the speed (in beats per minute), the mode (Stop, Play, or Record), and the sequence to be played. In other words, you must select a sequence, start the metronome and put the sequencer in Play mode in order to hear anything.



#### Playing a Sequence

The first thing you will want to do is listen to what the sequencer can do. Press UPPER FUNCTION, SELECT SEQ, and then any of the lit number switches. Tap out the beat on the footswitch (two beats will do) and press PLAY. If there is no sequence in that memory location, you will hear a "honk" sound telling you that you have requested the impossible, and the sequencer will remain in Stop mode. If there is a sequence, you will hear it played at the tempo you tapped on the footswitch.

#### Playing Along

When a sequence is played back, it plays separately from the keyboard. It is perfectly okay to play along with the sequencer. You may select different programs, set up links, move the keyboard split, etc. and the sequencer will keep playing, unaffected. The only limitation is that, since the Polaris only has six synthesizer channels, only six notes can be heard at once. However, you will notice that if you play "between" what the sequencer is playing, the Dynamic Voice Allocation feature of the Polaris will assign you extra voices as they become available. You can adjust your play-along volume by selecting VOLUME in the ASSIGNABLE CONTROL section, and moving the slider. Overall volume is still controlled by the slider in the MASTER section.

#### Recording a Sequence

The whole point of this sequencer is for the musician to be able to record either complex or repetitive sequences for play-back during live performances when not all attention can be focussed on just part of the whole sound. So let's record a sample sequence to become acquainted with the Polaris' sequencer.

When you record a sequence, you are intercepting all the information controlling the main sound, and recording it in memory. This includes all keyboard information, all lever, pedal and footswitch motion, all parameter changes, and all program selections. This does not include any link information. Since the sequencer can only record a single track (with no over-dubbing), it cannot record link sounds, so you should use sounds that have no link while recording.

Recording a sequence involves three phases, set-up, recording, and ending.

#### Set-up:

You must first tell the Polaris where you want to store the sequence you are about to create. The Polaris has the ability to store up to twelve sequences, one for each of the number switches in the BANK SELECT/PROGRAM SELECT section.

After you press UPPER FUNCTION, SELECT SEQ, switch F will flash, and switches with sequences will light up. Pressing an unlit number switch selects an empty slot in which to store your new sequence. Then press RECORD. You will hear the metronome (it will automatically start if it was stopped). You can now set the tempo using "Tempo Tap": Tapping the beat on the Metronome Footswitch will automatically set the tempo. Even though two taps are needed by the sequencer, it is suggested that you tap the desired tempo for several seconds to make sure it is correct.

During the set-up phase you are allowed to do non-performance related things in non-real-time. You may select a program, modify parameters in it, perhaps turn off a link or change the sound a bit, and everything you do will be recorded as if it all happened instantly. While in this phase, you can change your mind and press STOP and any sequence that might previously have occupied the slot you selected (if you selected a pre-recorded slot) will not have been lost. It is a good practice to make a cassette copy of any sequence that is important, as explained in Chapter 9.

The default program for the sequence is the currently selected program (at the time of recording). If you do not enter a program during set-up, the Polaris will record the currently selected program.

#### Recording:

As soon as you press the first key, or press the sustain footswitch, the actual real-time recording begins. At this time, any previous sequence will be erased. When you play the sequence back, everything that happened during the set-up phase will happen instantly, and the first real-time event will follow. The fact that pressing the sustain footswitch is considered a real-time event has special significance. If you want to put a countdown at the beginning of the sequence, start the real-time recording by pressing the sustain footswitch, and then start playing four (or however many) beats later. If you do not want a countdown, start the real-time recording by playing on the keyboard.

NOTE: Be careful when entering the Record mode: There is no built-in erase protect feature. When you are in the Record mode, as soon as a key or footswitch is activated the previous sequence in that slot is erased. Before entering the Record mode check to see which sequence has been selected. The Polaris will remember which sequence was selected when you turned the machine off but you probably won't, so it is a good idea to keep a written record of what musical information is stored in which sequence.

### Ending:

To stop the recording process, play an extra note (or press the sustain footswitch) on the beat that you want the sequence to end on, and then press STOP. The extra note will not be heard during playback; instead, it tells the recorder where to end the sequence, so that you don't have to frantically reach for the STOP switch.

### The Metronome

The metronome is normally controlled by the sequencer footswitch, and by the MASTER slider when LOWER FUNCTION, SLIDER TEMPO is selected. The metronome produces an audible click (the volume is adjustable), and also flashes the sequencer mode LED when it is running. The footswitch can do three things to the metronome:

If the metronome is stopped, pressing the footswitch once will start it at whatever tempo it was running at when it was stopped. If the metronome is running, pressing the footswitch once will pull the metronome (and any sequence being played or recorded) to the nearest beat. If the metronome is running, tapping the desired tempo on the footswitch will set the speed of the metronome.

It is also possible to start the sequence with the footswitch. If the metronome is running (as indicated by the flashing STOP LED), you must first stop the metronome by pressing STOP. When you press PLAY, nothing will be heard until you tap on the footswitch (or until you press PLAY a second time), starting the metronome. You can tell if the metronome is running by observing the status of the LEDs in the SEQUENCER section. If any of the LEDs are flashing, the metronome is on.

The metronome can also control an external drum machine or sequencer through the Sync Interface or the MIDI Interface, and can follow the external drum machine or sequencer through the same interfaces, or follow one interface and control the other. These features are explained in Chapter 13.

### Selecting a Sequence

At any time, one of the twelve available sequencer memories is "selected", ready for playing or recording over. To change this selection, press UPPER FUNCTION, SELECT SEQ, and a number switch. If you change your mind, you can abort the operation by pressing UPPER FUNCTION again.

### Seeing Which Sequence Is Selected

Pressing UPPER FUNCTION, WHICH SEQ causes one of the number LEDs to flash a few times, indicating which sequence memory is currently selected. A sequence memory can be selected yet have nothing in it.

### Pausing a Sequence

If you press PLAY while a sequence is already playing, the metronome will be stopped, causing the sequence to pause. Pressing PLAY again will cause the sequence to continue from where it left off. As a convenience, the metronome and sequence will be started at the nearest beat.

### Stopping a Sequence

Some sequences stop when they reach the end. A sequence may also chain to another sequence. In fact, if a sequence chains to itself, it will loop. At any time, though, the user can stop the sequence by pressing STOP. This puts the sequencer in Stop mode and stops the metronome. Pressing the footswitch (or pressing STOP a second time) will cause the metronome to start again but will not restart the sequence.

### Running Out Of Memory

The internal memory in the Polaris is assignable to either voice programs or sequences. If there are 132 programs in memory, about 700 notes are left for the sequencer. For each voice program you erase, an about eight more notes are made available for the sequencer. Make sure you have cassette copies of any programs you erase!

It is possible, while recording, that you will fill up the available memory. When this happens, you will hear the same "honk" sound you hear when you attempt to play a non-existent sequence, the MEMORY FULL LED will flash a few times, and the sequencer will automatically return to Stop mode. The sequence, up to the point at which the memory filled up, will be recorded properly, yet you will probably have to re-record it anyway, as its ending will be premature and ungraceful.

Once memory is full, you will discover that you cannot record a sequence; you must first do something to clear out some memory such as erasing the sequence that filled up the memory or erasing some programs. You might also notice you cannot store a program into an empty slot. You should, therefore, not leave the instrument with a completely full memory, as you may later find yourself wishing desperately for room to store some new hot sound you've discovered.

### Seeing How Much Memory There Is

Pressing UPPER FUNCTION, MEMORY USED causes the right half of the ASSIGNABLE CONTROL section to function as a bar graph, showing the approximate percentage of memory used. If all seven LEDs are lit up, memory is full. Press UPPER FUNCTION again to return the panel to normal operation.

### Erasing a Sequence

If you wish to erase a sequence, press UPPER FUNCTION, ERASE SEQ, number. If you change your mind, you can abort the operation by pressing UPPER FUNCTION again. Note that the sequence that gets erased is the one whose number you press, not the currently selected sequence. Also note that you cannot do this while the sequencer is recording or playing.

### Rearranging Sequences

If you wish to move sequences around, you can do this by swapping sequences. To swap the currently selected sequence with another, press UPPER FUNCTION, SWAP SEQ, number. If you change your mind, you can abort the operation by pressing UPPER FUNCTION again. You can completely rearrange all twelve sequences, whether or not they all

exist, by using this function repeatedly. Note that the current sequence NUMBER remains unchanged; that is, the current sequence is now the sequence you swapped with. Also note that you cannot do this while the sequencer is recording or playing.

#### The Sequence Workspace

When a sequence is played, it uses a separate workspace called the sequencer workspace for holding the program it is using. This workspace works just like the main and link workspaces, allowing parameters to be changed without affecting the stored version of the program.

#### Changing the Initial Program

Every sequence has an initial program number. If you select a program while in the set-up phase, the number of that program becomes the initial program number for the sequence. If you do not select a program at this time, the current program number (as shown in the LEDs) is taken to be the initial program number. When you play the sequence back, the program of that number is first copied into the sequencer workspace. After recording a sequence, you can change the initial program number by selecting the sequence and pressing UPPER FUNCTION, SEQ PROG, 1-12, or UPPER FUNCTION, SEQ PROG, A-K, 1-12. Program selections in the middle of the sequence cannot be change in this manner.

#### Manually Adjusting the Tempo

Sometimes, you wish to be able to manipulate the metronome tempo manually by moving a slider. If you press LOWER FUNCTION, SLIDER TEMPO, the slider in the Master section will be temporarily connected to the metronome. To get out of this mode and return the slider to its normal function, press LOWER FUNCTION again.

#### Keeping The Beat

If, while playing, you find that the sequencer is off in either direction by a beat (because, for instance, the drummer dropped a beat and everyone else followed) all is not lost. Simply press LOWER FUNCTION, FWD 1 BEAT to jump forward in time, or LOWER FUNCTION, BACK 1 BEAT to jump backward in time. This function works only in Play mode.

#### Looping and Chaining

If you want a particular sequence to repeat indefinitely, or chain to another sequence, press UPPER FUNCTION, CHAIN SEQ, 1-12. If the number is the same as the currently selected sequence, the sequence will repeat indefinitely when played back. If the number is different from the currently selected sequence, the sequence will chain to another sequence when played back. When you chain to a different sequence, that sequence also becomes selected, making it easy to set up another chain from that sequence.

This also means, however, that if you have two sequences chaining to each other, you will have to be careful about mid-course changes to the sequence tempo, sequence program, etc. The moment the first sequence starts, the second sequence is loaded in. If you make

changes to, for example, the tempo, you won't hear the changes until the second sequence starts to play.

It is possible to chain all twelve sequences together. It is not possible, though, to create chains such as 1, 2, 1, 3, as each sequence can chain only to one other sequence.

#### Automatic Looping

A "shortcut" for setting up a loop is provided. If you press PLAY instead of STOP when you finish recording a track, the track is automatically set up to loop to itself. Conceptually, you can think of this as recording the PLAY switch.

#### Adjusting the Loop or Chain Point

When you record a loop or a chain, you may find that you have miscalculated, and there is an extra beat or a missing beat at the end of a sequence. If you press LOWER FUNCTION, FWD 1 BEAT while in Stop mode, you will modify the currently selected sequence by chopping one beat from the end. If you press LOWER FUNCTION, BACK 1 BEAT while in Stop mode, you will modify the currently selected sequence by adding one beat to the end. The logic behind this is that skipping forward in time makes the sequence shorter, while skipping backward in time makes the sequence longer. Again, these operations must be performed while in Stop mode.

You will notice that no matter what you do, the starting point and ending point of all sequences will always fall on a beat boundary. This vastly simplifies the process of accurately splicing the ends of a loop or a chain.

#### Automatic Sequence Cueing

If you press LOWER FUNCTION, SEQ CUE, the currently selected sequence will be modified so that when it ends, the metronome is stopped. If you combine this with looping or chaining, the loop or chain operation will take place at the end of the sequence as usual, but the following or looped sequence will not be heard until you restart the metronome by pressing the footswitch or pressing PLAY again.

If the automatic sequence cueing feature has already been enabled for the selected sequence, you can disable it again by pressing LOWER FUNCTION, SEQ CUE.

#### Recording the Sequence Tempo

Normally a sequence is played at whatever the current metronome rate is. If you want a sequence to be played at a different rate, you must use the footswitch to change the metronome rate, which takes at least two footswitch presses. It is possible, though, to modify a sequence so that it will always play back at a particular tempo. To do this, select the sequence, set the metronome rate, and press LOWER FUNCTION, SEQ TEMPO. The tempo will be recorded at the beginning of the sequence, and will take effect whenever the sequence is started.

If you wish to remove the tempo from the beginning of a sequence, so that it no longer forces the metronome to a particular tempo whenever you play the sequence, simply select the sequence, stop the metronome,

and press LOWER FUNCTION, SEQ TEMPO. This is useful when using Tempo Tap to adjust the metronome rate, especially with a short looped sequence.

#### Adjusting the Click Volume

To adjust the volume of the click you hear while recording, press LOWER FUNCTION, ADJUSTMENT, 2, and use the MASTER slider. When you have set the volume, press LOWER FUNCTION again to restore the control panel to normal operation. You do not need to be in Record Mode to do this. See Chapter 15 for more details on this and other adjustments.

#### Selecting a Sequence While Playing

The sequence chaining mechanism has an interesting feature that can be exploited during a performance. When a sequence is played, if it has a chain, the sequence to be chained to is immediately selected, even while the previous sequence is being played. In other words, if sequence 1 is chained to sequence 2 and you play sequence 1, as soon as sequence 1 has started, sequence 2 will be selected so that it will be ready to play when sequence 1 is finished.

This means that while sequence 1 is playing, you can select a different sequence by pressing UPPER FUNCTION, SELECT SEQ, 1-12, and that sequence will be chained to when the end of sequence 1 arrives, instead of sequence 2. This does not modify sequence 1; next time you play it, it will still chain to sequence 2.

## CHAPTER 9/THE CASSETTE INTERFACE

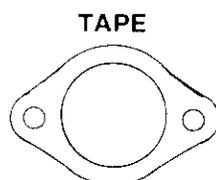
### CASSETTE INTERFACE

The cassette interface allows the user to save programs and sequences on tape, reload programs and sequences from tape, and verify the correctness of the data on tape. If you find yourself running out of memory, recording programs and/or sequences on tape allows you to completely change the internal memory of the Polaris, and then restore your original settings later.

The data cassette provided with the Polaris is an exact duplicate of the factory voice programs and sequences. If anything should ever happen to the memory in your Polaris, you have a method of re-installing it. If you do not already have a cassette recorder, you should get one and learn how to use it. We recommend the Radio Shack model CLR-81.

#### Connecting The Cassette Recorder

The cassette interface uses the 5-pin DIN connector (CASS) on the rear panel to connect the Polaris to an inexpensive portable cassette machine.



**CAUTION**  
DO NOT USE TAPE  
JACK AT SAME TIME  
AS SYNC IN JACK

The optional Cassette Adapter plugs into this connector and provides the standard three miniature plugs most recorders use. These are:

Small gray plug --- This is used to turn the motor in the cassette machine on and off. Since it is a different size than the other two plugs, it will only fit into one of the jacks on the cassette machine

Large gray plug --- This is used to feed data into the microphone input on the cassette machine. The jack this goes into will probably be labelled "MIC." Typically, the two gray plugs will be in adjacent jacks.

Black plug --- This is used to feed data from the earphone output into the Polaris. The jack this goes into will probably be labelled "EAR" or "PHONE."

If you wish to use the Polaris with a non-portable cassette machine, you must use some other form of adapter. Rather than try to adapt the 5-pin DIN connector or the miniature plugs to your cassette machine, you can use the SYNC IN and SYNC OUT jacks. These jacks connect in

parallel with the data in and out pins on the DIN connector, and are easier to find adapters for. Note, however, the cassette motor control functions of the Polaris are not available in this configuration, and you will have to manually start and stop the cassette machine at the appropriate times.



#### Saving One Program

To save a single program, place the cassette machine in record mode and press UPPER FUNCTION, SAVE PROG. The cassette machine will be started if not already running, the main workspace program will be written to the tape, and the tape will be stopped. Remember that the program saved is the one in the workspace, not the stored version of it. Therefore, if you select a program, modify it, and then save it, the modifications will be saved as well.

If you save a program with a link, the link-related parameters are saved, but the program you are linked to will not be. It is up to you to save the linked program, and to store it in the correct place in memory when reloaded.

#### Saving All Programs

To save all the programs in memory, place the cassette machine in record mode and press UPPER FUNCTION, SAVE ALL PROGS. The cassette machine will be started if not already running, all 132 programs will be written to the tape, and the tape will be stopped. If a particular program does not exist, a "null program" is recorded on tape so the existing programs will be correctly positioned when reloaded.

As the programs are saved, the letters and numbers will show which program is being saved at any given instant. If you wish to stop the save operation, press UPPER FUNCTION. This may result in a program being only partially recorded on tape, and this partial program will not be loadable.

#### Saving One Sequence

To save the currently selected sequence, place the cassette machine in record mode and press UPPER FUNCTION, SAVE SEQ. If the sequence does not exist, you will hear a honk, and the operation will not take place. Otherwise, the cassette machine will be started if not already running, the sequence will be recorded on the tape, and the tape will be stopped.

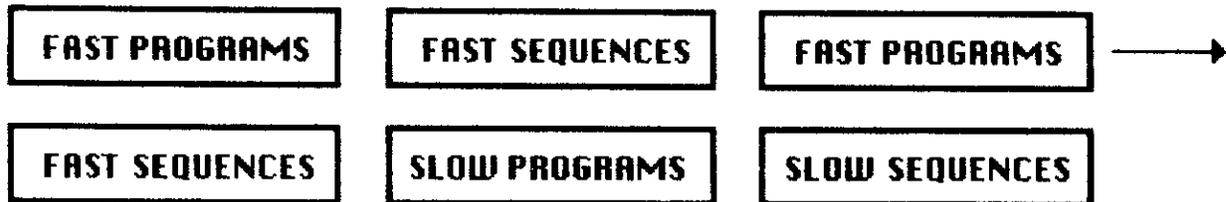
If you wish to stop the save operation, press UPPER FUNCTION. The portion of the sequence on tape will not be loadable, and should be erased or recorded over.

### Saving All Sequences

To save all the sequences in memory, place the cassette machine in record mode and press UPPER FUNCTION, SAVE ALL SEQS. The cassette machine will be started if not already running, all twelve sequences will be recorded on the tape, and the tape will be stopped. If a particular sequence does not exist, a null sequencer is recorded on tape so the existing sequences will be correctly positioned when reloaded.

As the sequences are saved, the numbers will show which sequence is being saved at any given instant. If you wish to stop the save operation, press UPPER FUNCTION. This may result in a partial sequence being recorded on tape, and this partial sequence will not be loadable.

The factory data cassette has the voice programs and sequences recorded two ways. The first is a fast save, which is ideal for loading all voices or sequences quickly. The second is a slow save, which is ideal for loading a specific voice or sequence. The slow save has spaces between each program, while the fast save has spaces between every third program. Because the data is so important, the fast save portion repeats itself in case one version should become damaged. There is only one copy of the slow save portion.



#### Loading One Program

Loading data from a cassette into the Polaris might take some experimentation. Depending on the type of cassette deck, manner in which the tape was recorded, and configuration, it may take a minute or two before everything goes just right. If the Polaris is unable to read the data on the tape, the loading operation will stop, the tape will be stopped, and you will hear a "honk" sound indicating an error has occurred. Rewind the tape and try loading again with a different volume setting. Be patient and keep trying...it WILL work.

To load a single program, place the cassette machine in play mode and press UPPER FUNCTION, LOAD PROG. The cassette machine will be started if not already running, and data will be read from the cassette. The LOAD PROG switch LED will indicate when data is detected. Data will be read and discarded until a program is encountered. This program will be loaded into the main workspace, and the tape will be stopped. None of the 132 stored programs are overwritten by this; if you wish to keep the sound, you must manually store it someplace. If you wish to stop the load operation, press UPPER FUNCTION.

#### Loading One Sequence

To load a single sequence, select a sequence memory that is either empty or that you are willing to overwrite, place the cassette machine in play mode and press UPPER FUNCTION, LOAD SEQ. The cassette machine will be started if not already running, and data will be read from the cassette. The LOAD SEQ switch LED will indicate when data is detected. Data will be read and discarded until a sequence is encountered. This sequence will be loaded over the currently selected sequence, and the tape will be stopped. If you wish to stop the load operation, press UPPER FUNCTION.

### Loading Everything

To load everything from the tape, including both programs and sequences, place the cassette machine in play mode and press UPPER FUNCTION, LOAD ALL. Because the Polaris can tell whether it is loading programs or loading sequences, only one LOAD ALL switch is needed. The Polaris maintains an internal counter for programs and another for sequences. If the tape was prepared by SAVE ALL PROGS or SAVE ALL SEQS, it will contain instructions to reset these counters so the first program will be loaded into program bank A, number 1, and the first sequence will be loaded into sequence memory 1. As programs and sequences are played from the cassette, they are placed in memory and the appropriate counter is advanced. If a "null program" or "null sequence" is read in, the corresponding program or sequence memory is erased.

The operation continues until you manually interrupt it by pressing UPPER FUNCTION, or until it reads a "stop" signal from the tape itself. This stop signal is appended to the tape whenever you use SAVE ALL PROGS or SAVE ALL SEQS. Thus, if you have saved all your programs and sequences with those functions, you must use LOAD ALL to load the programs, and then use LOAD ALL again after the tape stops to load the sequences.

### Running Out of Memory

When you load programs or sequences from tape it is possible, of course, to run out of memory. When this happens you will hear a "honk" sound, the tape will be stopped, and the loading operation will stop. In addition, the MEMORY FULL LED will flash a few times. Whenever you hear the "honk" sound during a cassette load, look at this LED. If it is flashing, the memory has filled up. If it is not flashing, an error was detected and the operation should be retried.

Sometimes you will run out of memory while loading a set of sequences that is small enough to fit into memory. This happens when the higher-numbered sequences in the Polaris are longer than the lower-numbered sequences in the Polaris, but the higher-numbered sequences on tape are shorter than the lower-numbered sequences on tape. As each sequence is read from the tape, the previous sequence of the same number is erased. Thus, you will be trying to load the longer, low-numbered sequences from tape before the longer, high-numbered sequences in memory have been erased.

This also occurs when loading groups of programs containing empty program slots, when the empty slots on tape have higher numbers than the empty slots in memory. The solution in either case is to manually erase some of the higher-numbered sequences or programs and then retry the load operation.

### Verifying a Cassette

To ensure the data on the cassette can be properly read (without actually overwriting everything in memory), place the cassette machine in play mode and press UPPER FUNCTION, VERIFY. The cassette machine will be started and will continue to run until you press UPPER FUNCTION again, or until an error is detected on the tape.

### Controlling the Cassette Motor

To start or stop the cassette motor while you are not in the middle of loading, saving or verifying, press UPPER FUNCTION, CASS RUN/STOP.

### The Cassette Monitor

The Polaris contains provision for monitoring the sound of the data enroute between the cassette and the main Polaris output.

NOTE: Keep the MASTER slider low, as digital information is not the most pleasing sound.

It is also possible, using the cassette machine's microphone, to record verbal descriptive messages between the data on the cassette. During a load operation, if this function is enabled, you will hear these messages through the main output. You will also hear the data as it is loaded, and this is useful as an audible indication of how the load operation is progressing. You can also listen to the data being sent to the cassette machine during a save. This is useful as an audible indication of how the save operation is progressing.



To set the cassette monitor mode, press LOWER FUNCTION, CASSETTE. The LEDs in switch numbers 1 and 2 will show the current settings of the cassette monitor.

LED 1 OFF - The input from the cassette is not heard in the main output.

LED 1 ON - The input from the cassette is heard during loads and verifies. Pressing the number 1 switch toggles this back and forth.

LED 2 OFF - The output to the cassette is not heard in the main output.

LED 2 ON - The output to the cassette is heard during the saves. Pressing the number 2 switch toggles this back and forth.

Pressing LOWER FUNCTION again returns the panel to normal operations.

### The Cassette Input and Output Levels

The cassette input and output circuits can be adapted for use with different types of cassette machines. Some audio cassette recorders require high-level inputs. Some personal computers use a "digital" cassette machine, which looks similar to an audio cassette recorder, but doesn't have audio input and output amplifiers. The owner's manual for your cassette deck will help you determine what levels to use. To specify the type of machine you are connecting to, press LOWER FUNCTION, CASSETTE. The LEDs in switch numbers 3 and 4 will show the current settings of the cassette input/output circuits.

NOTE: The factory data cassette was originally recorded with LOWER FUNCTION, CASSETTE, 3 and 4 off. To re-load we suggest 3 and 4 again be set off. However, don't worry if you forget to set them properly. Experimentation won't hurt anything.

LED 3 OFF - The input circuit is set up for connection to an audio output, such as an earphone jack.

LED 3 ON - The input circuit is set up for connection to a digital output with an RS-232C or TTL level. Pressing the number 3 switch toggles this back and forth.

LED 4 OFF - The output circuit is set up for connection to the microphone input of an audio cassette machine.

LED 4 ON - The output circuit is set up for connection to the input of a digital machine. In this mode the Polaris puts out a very strong signal, one that is capable of driving high-level audio inputs (such as AUX IN on most home stereos). Be sure to set the the high-level audio input gain low (on the recorder) when using the Polaris in this fashion. Pressing the number 4 switch toggles this back and forth.

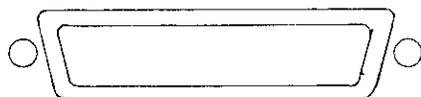
Pressing LOWER FUNCTION again returns the panel to normal operations.

NOTE: If you are using a home stereo cassette machine, turn all noise reduction (Dolby or dbx) off. Always use high-quality tape. We suggest you buy "Certified" data cassettes, which are available at Radio Shack or many computer stores. Any tape "drop-out" can cause a problem when storing digital data.

## CHAPTER 10/THE CHROMA INTERFACE

### CHROMA INTERFACE

The Polaris includes a Chroma Interface on the rear panel compatible with the Chroma Interface on the original Chroma or the Chroma Expander. The Chroma Interface allows a computer to control the Polaris through the use of the Chroma Interface Kit, Model 1611 (Fender P/N:30-8513-601). In order to connect the Polaris to a Chroma, Chroma Expander, or computer, a Chroma Computer Interface Cable (Fender P/N:30-5711-201) must be used.



CHROMA INTERFACE

This is necessarily a rather technical subject, the full extent of which is beyond the scope of this manual. A more technical view of the Chroma Interface is found in the Chroma Computer Interface Manual (Fender P/N:30-9004-901). This section will, however, help you understand some of the basics involved with using the Chroma Interface.

#### Differences Between the Polaris and the Chroma

If you are already familiar with the Chroma Interface, you must become aware of certain differences between the Polaris and the Chroma that effect the operation of the Chroma Interface. These differences will present a problem only if you are using a computer with software intended for controlling a Chroma, or if you have a Polaris directly connected to a Chroma. They will not be a problem if you are using a computer with software designed for the Polaris, or if you have two Polaris connected. Some of the differences between the two instruments are:

The Polaris has 132 programs, while the Chroma has 50. In addition, individual Polaris programs may not exist, while all 50 Chroma programs always exist.

The Pedal 2 and Footswitch 2 commands produced by the Chroma are ignored by the Polaris. Pressure commands are understood by the Polaris as Pedal. There is interaction between the Pedal and Pressure commands, so it is desirable not to have both of them sent to the Polaris at the same time.

The number and meanings of the parameters in a Polaris program are completely different from the parameters in a Chroma program.

Even though there are only six voices, there are still eight logical instruments. Since the Polaris practices Dynamic Voice Allocation, it is possible to make use of eight instruments as long as no more than six notes are played at a time.

The Chroma only transmits main and link information. The Polaris can also transmit sequencer information. In addition, the Polaris has independent control over all three data streams, so it is possible to make the sequencer send its data out the Chroma Interface while the keyboard plays internally.

The Chroma uses Read Program and Write Program commands to upload and download programs. The Polaris has a more elaborate scheme involving the Peek and Poke commands that also gives access to sequences and other internal data objects.

#### The Chroma Panel Switch

If you wish to use the Chroma Polaris with another instrument directly, without an intervening computer, you must set certain modes from its control panel. First, you must tell the Polaris whether it is talking to another Polaris (or to a computer that understands the Polaris language) or if it is talking to a Chroma. Press LOWER FUNCTION, CASSETTE. This causes the number switches to display various configuration parameters. See Chapter 17 for a complete listing of the options under LOWER FUNCTION, CASSETTE.



The Chroma Interface uses LOWER FUNCTION, CASSETTE, 7 to control what is called the Chroma Panel Switch. This software switch enables or disables the transmission of control panel-related information from the Polaris to the Chroma or Chroma Expander. After pressing LOWER FUNCTION, CASSETTE, if the LED for switch 7 is off, the Polaris will not be allowed to transmit any parameter changes (Set Parameter commands) or program changes (Define and Undefine commands). Only performance-related information will be transmitted. After pressing LOWER FUNCTION, CASSETTE, if the LED for switch 7 is on, the Polaris will transmit parameter changes and program changes in addition to the performance information.

Pressing the switch toggles the switch and the LED on and off. To return the panel to its normal operation, press LOWER FUNCTION again.

Obviously, if you connect the Polaris to a Chroma, you will usually want to have the Chroma Panel Switch off, as the Chroma would only be confused by the panel information from the Polaris. If you connect the Polaris to another Polaris, though, you will most likely want it on. This configuration is remembered even when you turn the power off.

#### Sending a Program

If you have two Polaris connected, you can send the program in the Main Workspace of one Polaris to the Main Workspace in the other. While the sending Polaris is in the LOWER FUNCTION, CASSETTE Mode, press switch number 11. The program will be sent to the other Polaris. From there, it can be manually stored someplace in the memory of the second Polaris, if desired. This works even if the Chroma Panel Switch is off. Remember to press LOWER FUNCTION again to return the panel to its normal operation.

## Routing Data Streams

There are three separate "data streams" that can flow through your Polaris. They are the main, link, and sequencer. If you have a Polaris connected to another instrument, you must tell the Polaris which data streams (main, link, or sequence) are to be played locally (internally) and which are to be sent out over the Chroma Interface. (In addition, you can send data out over the MIDI Interface; see the next chapter for more information.) Press LOWER FUNCTION, INTERFACE to access the Computer Interface Routing menu. This assumes the main instrument is data stream 1, the link instrument is data stream 2, and the sequencer is data stream 3.

LOWER FUNCTION,INTERFACE,1 - Main Local Control Switch  
LOWER FUNCTION,INTERFACE,2 - Link Local Control Switch  
LOWER FUNCTION,INTERFACE,3 - Sequencer Local Control Switch  
LOWER FUNCTION,INTERFACE,4 - Main Chroma Out Switch  
LOWER FUNCTION,INTERFACE,5 - Link Chroma Out Switch  
LOWER FUNCTION,INTERFACE,6 - Sequencer Chroma Out Switch

The Local Control Switches, 1,2 and 3, selectively allow the Main, Link and Sequencer information to go to the internal logical instruments. The Chroma Out Switches, 4, 5 and 6, selectively allow the Main, Link and Sequencer information to be transmitted over the Chroma Interface. Pressing any one of these switches toggles the parameter and the LED on and off.

Switch number 1 should generally be left on. If it is off and you select a program that has a link, the link will not get set up. Also, keyboard splits will not work properly. This is because all link related information comes from the parameters in the Main Workspace, and when switch 1 is off program changes never get to the Main Workspace. Do not change these parameters when keys are depressed, as some notes may be left hanging without releases. If this happens, to a LOWER FUNCTION, RESET.

Thus, if you want part of the sound played internally and another part to be sent out to another Polaris, you should have the main sound play internally and use the other instrument for the other sound. For instance, you might turn on switches 1, 2 and 6. This will cause the main and link sounds to play internally while the sequencer plays on the other Polaris.

If you have a Polaris and a Chroma, you may find it useful to turn on switches 1,3 and 5. In this mode, the main and sequencer sounds will play internally, while the link sound will be sent out to the Chroma. To hear anything from the Chroma, though, you must select a program on the Chroma that has a link. Since both instruments are so powerful and versatile, there are a number of options and configurations you should be aware of in order to get the maximum from this interface.

## Connecting the Polaris to a Chroma

If you want to layer sounds between the two instruments, the configuration is very simple. You turn on LOWER FUNCTION, INTERFACE, 1 and LOWER FUNCTION, INTERFACE, 4 (the other switches don't matter in this case) and select a sound with no link in both instruments. All

notes will be played by both units. This works regardless of whether the other instrument is a Chroma or a Polaris. If a link configuration is desired, LOWER FUNCTION, INTERFACE, 2 and LOWER FUNCTION, INTERFACE, 5 must be on. In order for the Chroma or second Polaris to understand the link command, a Link Upper, Link Lower, or Link Unison must be established in the Polaris that is controlling the setup.

In order to gain access to the Polaris Sequencer from a Chroma, there are certain procedures that must be followed:

LOWER FUNCTION, CASSETTE, 7 must be on.  
LOWER FUNCTION, INTERFACE, 6 must be on.

With the Chroma Panel Switch on, program change commands are sent to the Chroma. The program change command is part of the sequencer stored in the Polaris. Since the Polaris is capable of storing 132 programs and the Chroma can store only 50, make sure the program selected on the Polaris is between A, 1 and E, 2. These Polaris program numbers correspond to 1 through 50 on the Chroma. If a Polaris program beyond E, 2 is sent to the Chroma, the results are unpredictable. If the Chroma is not responding properly, a "SET SPLIT 50" will re-set the Chroma.

Now that you have selected an appropriate program on the Polaris make sure the sequencer data is being sent to the Chroma by turning LOWER FUNCTION, INTERFACE, 6 on. When playing the sequencer through the Chroma Interface to a Chroma, you will have no problems with sequences record via the Chroma to the Polaris. However, if you plan to record Polaris sequences in the Polaris to be played over the Chroma Interface to a Chroma, you must do one of two things: If you have a optional Polaris volume pedal, fully depress the pedal with your toe before playing a note. Otherwise, you must set volume modulation (parameter 50) to value = 0, and store the altered program in the Chroma.

NOTE: If the LEDs are dimming when you play the sequence but you can't hear the sequence, the volume is all the way down. You must follow the procedure carefully to avoid this problem.

If the Chroma Panel Switch is off, the Chroma or Expander will not be able to properly define the instrument coming from the Sequencer and again nothing will work.

It may be desirable to record a sequence into the Polaris' Sequencer from the Chroma. In order to do so a "SET SPLIT 17" and a "SET SPLIT 19" must be done on the Chroma. This establishes the communication between the Polaris and Chroma, and standard Sequencer recording procedures can then be followed. To ensure the Polaris will store an appropriate program number for this sequence, manually select the program from the Chroma's control panel while in the set-up phase. The Chroma will now send a Define command to the Polaris and store the proper Chroma program number as part of the Polaris sequence.

When the power is first turned on, the Local Control Switches will be on and the Chroma Out Switches will be off. Thus, you will have to redo this configuration whenever you turn on the instrument if you wish to transmit to another instrument. The receiving instrument needs no reconfiguration.

Again, remember that interfacing can be somewhat frustrating at first, so be patient, read the information, and don't be afraid to experiment.

## CHAPTER 11/AN INTRODUCTION TO THE MIDI

### An Introduction to the MIDI

The MIDI (Musical Instrument Digital Interface) is a system for connecting together various electronic musical instruments and computers. In the past, connecting synthesizers from different manufacturers was frequently not possible due to differences in the design of the units. The MIDI was developed to eliminate these differences and to facilitate the processing of musical information.

The MIDI allows the musician to simply plug together two instruments and begin playing without concern for control voltages, connector types, etc. These instruments include synthesizers, drum machines, and guitar synthesizers, among others. Instruments may transmit musical information to sequencers and computers for storage, processing and later playback.

The language of the MIDI is not audio signals but rather, digital or computer signals. This separates the performance information (which notes, how long and loud, etc.) from the generation of the sound. Because of this, the design of the instruments' circuits do not prevent them from working together.

Another benefit of this approach is it allows modular design of systems. That is, the control devices (keyboard, guitar controller) can be separated from the sound generating parts of the system. This does two things. First, it reduces unnecessary duplication of components by eliminating multiple keyboards. For example, if a musician likes a particular keyboard because it is touch-sensitive or it has a nice feel, he does not have to buy an entire synthesizer to get it. Second, he can customize his system by picking and choosing those modules from different manufacturers that best satisfy his special needs.

Since MIDI devices communicate digital information, this means they can be interfaced to computers. The use of computers for music information processing will greatly enhance the musician's capabilities. With the appropriate software, computers can be used as sophisticated sequencers, for editing and printing musical scores.

The MIDI will be a boon for computer-assisted musical instruction because it allows computers to directly control instruments. Computers are useful for tasks such as ear-training and dictation that consist of playing one or more measures and then asking the student a question. In the past, the necessity of having a teacher available to play and judge meant a limited amount of time was dedicated to these drills. In addition, playing simple melodies over and over is boring for the instructor. However, this is the type of task that is perfectly suited to a computer. The computer can keep track of those areas in which the student does well and those areas in which the computer does poorly, for later presentation to the instructor.

A variety of software is currently available for the Commodore 64, Apple II, and IBM Personal Computer.

Retrofits are also available to connect MIDI equipment to non-MIDI devices.

#### Hardware and Connections

Physically, the MIDI consists of a 5-pin DIN plug and an opto-isolated current loop. The plug ensures any two MIDI devices may be plugged together and the current loop provides for electrical separation between devices. Electrical isolation means that if one unit short circuits or otherwise malfunctions, the other units are protected.

The MIDI instruments are equipped with an IN, an OUT, and sometimes a THRU plug. Sophisticated software in the Polaris allows the user to configure the OUT jack for duty either as an OUT or THRU jack. The IN plug accepts information from another synthesizer, sequencer, or computer and plays it. The OUT plug sends information about notes being played on an instrument to another MIDI device. A typical connection of two synthesizers would be to connect the OUT plug of the synthesizer being played to the IN of another one. With this arrangement, any notes being played on the first unit (the master) would also be played on the second (the slave). The patch (or sound) being played on the second may or may not be the same as that being played on the first.

Another typical setup would be to connect the OUT of a synthesizer or other instrument to the IN of a sequencer or computer. The sequencer or computer would record the performance being played. If a computer were used, it could store the performance on a disk for later manipulation. The capacity of the microcomputer disks varies but can range as high as 10 megabytes (the equivalent of several million notes).

To connect several synthesizers, the THRU plug is used. The THRU plug provides a copy of the information coming to the IN plug. To connect three synthesizers, the OUT of the unit being played (the master) would be connected to the IN of a second (the first slave), and the THRU of the second would be connected to the IN of the third (the second slave). In this way, the notes played on the first instrument would be transmitted to both of the other instruments. The THRU of the third could then be connected to the IN of a fourth unit, and so on. The interconnection of devices in this manner is referred to as a "daisy-chain."

It is important to note that the THRU plug does not transmit any notes played on the second or subsequent instruments. These are available only at the OUT plugs of those instruments.

Information is transmitted at a rate of 31.25 kBaud, or 31,250 bits per second. This amount of information is approximately equal to 800 notes per second. This is more than enough to capture alive performance by any musician although sequencer and computers may send information at speeds approaching this limit.

## The MIDI Language

Now that we know how to connect MIDI-equipped devices, we need to know what they can say to each other. The MIDI provides for the communication of a variety of musical information including notes, dynamics, pitch bend, program (patch) selection, and timing.

These events are communicated via a series of codes comprised of numbers. There is a code number to indicate each type of event; whenever an event of a particular type takes place, the code number is sent. For most even types, there are also numbers to indicate the value or magnitude of the event, such as pitch, loudness, etc.

Note events are the most common and basic type of data transmitted between MIDI devices. Each time a key is pressed a NOTE ON event is generated by a MIDI synthesizer. This NOTE ON event is then sent to the OUT plug and therefore to any instrument connected to it. Each NOTE ON event is assigned a number for 0 to 127 to indicate the pitch. Middle C is given a value of 60, while the C an octave below has a value of 48 and the C an octave above has a value of 72. When a key is released, a NOTE OFF event for the appropriate key is generated and sent to the OUT plug.

For instruments with velocity-sensing keyboards (like your Polaris), a velocity is also sent with each NOTE ON/NOTE OFF event. This velocity may have a value from 0 to 127. In addition, for appropriately-equipped instruments, a pressure or after-touch value may be sent. Again, the value may range from 0 to 127. Depending on how the instruments are programmed, the velocity may control dynamics, modulation, envelope generation, or any other sound parameter. This is, of course, dependent on the capabilities of the instrument.

Whenever a new program or patch is selected on a MIDI instrument, this information may be sent. In this way, the other instruments can change to a different sound without the musician having to manually select it on each unit. The program change information consists of a number for 0 to 127 so this only tells the other units which programs to use. It does not tell them anything about what the program sounds like. The performer must program the desired sound in the appropriate program number on each synthesizer in advance. The MIDI does not provide specific parameter change information; if you change the envelope attack on the Polaris, do not expect this parameter to change on the other MIDI instruments you have connected up. If, however, you are connecting two Polaris, you can transfer parameter information from one to the other.

The MIDI has provisions for a number of continuous controllers such as pitch bend wheels and sustain footswitches. The positions of these controllers are sampled periodically and whenever a change is detected, a message is sent. Values for the controller data may range from 0 to 16383. Up to 32 continuous controllers may be accommodated by the MIDI. These may control effects such as vibrato, sustain, and portamento (glide).

The MIDI timing information consists of Real Time Messages. These messages include Start, Stop, Continue (not implemented on the Polaris), Timing Clock, and Active Sensing. Start Stop, and Continue begin, continue, or end transmission of a stored sequence. The timing clock provides a clock at 24 steps per beat while the transmitter is in Play Mode. Active Sensing is a mode in which a message is sent every 300 milliseconds. When in this mode, a receiver expects the message every 300 milliseconds and if it is not received, the receiver turns off all voices and returns to normal operation. This is a way of ensuring the transmitter is on-line and actively transmitting. If for any reason this should not be the case, the receiver(s) will not be left with notes on indefinitely. The Polaris does not generate this optional message and it ignores it if it is received.

#### MIDI Channels

The MIDI provides 16 channels for directing the above musical data to the appropriate devices. In this way, the musician can send one part of a performance to one instrument and another part to another instrument. For example, when playing a split keyboard, it may be desirable to send notes played on the upper half of the keyboard to one instrument and the notes played on the other half to a different instrument. By assigning the upper half of the keyboard to transmit on one channel and the other half to transmit on another channel, the two parts can be kept separate. If the audio output of all three synthesizers is mixed together, the effect would be a two-layered sound with the main keyboard contributing to both the upper and lower registers while the other two are playing in only the upper or lower. In the Polaris, the sequencer can send its event data to a third channel.

In the case of a computer transmitting MIDI information, it is possible for the computer to send data fast enough to control all sixteen channels. This would allow a computer to function as a 16-track digital recorder. A passage could be recorded one or more channels at a time and played back to accompany a band for studio recording or live performance. However, as mentioned earlier, this may approach the MIDI "speed limit."

#### MIDI Modes

Several modes are available for controlling what information is sent where and what is done with it when it is received. These are called OMNI ON/OMNI OFF and POLY/MONO. As there are two settings for each mode, there are four possible combinations. These modes affect the transmission of MIDI information differently, depending on whether they are transmitting or receiving.

For the receiving instrument, OMNI ON means it will respond to messages received in any channel. For example, if a synthesizer with a split keyboard were transmitting the melody in one channel and the harmony in another, a receiving synthesizer in OMNI ON mode would play both parts. This is the normal condition when a unit is turned on and allows us to connect and play instruments without having to assign each one to a specific channel.

In OMNI OFF, a unit will respond only to messages received in an assigned channel. This allows us to route different parts of a piece to selected instruments.

In POLY Mode, any number of voices may be played simultaneously, while in MONO Mode only one voice per channel may be played.

For transmitting instruments, OMNI ON means all messages will be sent in a single channel called the basic channel. OMNI OFF means messages for each voice are sent in separate channels.

With OMNI ON, in POLY Mode a transmitter will send messages for all voices in the assigned basic channel. In OMNI ON, MONO, a unit will send messages for only one voice, again in the basic channel. In OMNI OFF, MONO, messages may be sent for a designated number of voices, with each voice being sent on a separate channel. The messages for the first voice are sent on the basic channel, with messages for the additional voices sent on the following channels.

#### System Exclusive

To enable instruments to communicate musical information of a type not explicitly defined by the MIDI standard, the System Exclusive facility has been provided. This is a mechanism by which an instrument can notify the other instruments that a special message is about to be transmitted. It is a code that tells all instruments not recognizing the code to simply ignore what follows. If this were not done, the instruments without the ability to respond to the special information would become confused and react in unpredictable ways.

System Exclusive is usually used by manufacturers to extend the capabilities of their instruments and to allow two or more of their instruments to communicate information specific to the particular model(s). This feature may be used, for example, to communicate the values of the sound parameters such as envelope, which may not normally be controllable through the MIDI. The Polaris has exceptionally powerful System Exclusive capabilities.

#### Compatibility

The MIDI specification provides a framework for communicating the musical information discussed above but it does not require that all functions be present on all instruments. In fact, most instruments implement only a subset of the full MIDI specification. In most cases, all the important functions are present and if you simply want to play one instrument from the keyboard of another, there should be no problem.

However, it is important to be aware of just which features are available on your instruments. For example, some units can transmit information on any of the 16 channels while others transmit on only channel one.

It is also important to realize that just because a piece of musical information can be transmitted, this does not mean the receiving unit will necessarily be able to respond to it in the desired way. For example, suppose you are playing a multi-timbral instrument that

allows you to play two sounds on each key. If this instrument is connected to one without this feature, the second instrument is only going to play one sound.

Another example would be touch-sensitive keyboards. Even though the keyboard is transmitting the velocity, if the receiving synthesizer is not also velocity-sensitive, it will most likely ignore this information. Even if both instruments are touch-sensitive, in one it may be polyphonic and in another it may be monophonic.

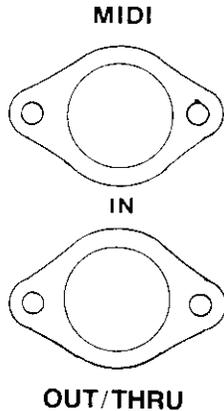
In order to get the most from the MIDI, you the buyer need to determine exactly which features you need and whether the instruments you are considering will provide them. To do this, you must read the literature available from the manufacturer. Ask your dealer if you can read the owners' manual before you buy.

Above all, be patient. Interfacing can be a rewarding but sometimes frustrating experience. If your system does not seem to be working properly, check your connections, check your MIDI channel assignments and MIDI mode configurations, and if all else fails, re-read the manual.

## CHAPTER 12/THE MIDI

### THE MUSICAL INSTRUMENT DIGITAL INTERFACE (MIDI)

The Polaris includes a MIDI on the rear panel compatible with the MIDI Specifications 1.0, with certain exceptions. There are some minor limitations that should not affect compatibility with other instruments; there are also some unique features that make the Polaris an ideal MIDI controller in a system using other MIDI compatible instruments.



The MIDI was designed for communication between two instruments, although it is still quite powerful when used to connect the Polaris to a computer. Usually, interfacing the Polaris with a computer will be accomplished via the Chroma Interface. This chapter deals with the user's view of the Polaris MIDI; the technical details needed to use the Polaris with a computer are covered briefly in Chapter 13.

#### Polaris MIDI Features and Limitations

The Polaris can transmit on three MIDI channels and can receive on up to eight. The routing of data streams (main, link, and sequencer) within the instrument is quite versatile, allowing, for instance, the sequencer to play another instrument while the keyboard plays internally.

The Polaris' metronome can be synchronized with other devices (drum machines, sequencers, other Polaris) through the MIDI as well as through the Sync Interface. The Polaris can be either a master or a slave.

If the MIDI is in Poly Mode, each MIDI channel the Polaris is programmed to respond to can be played polyphonically. Since the Polaris practices dynamic voice allocation, the limitation is Polaris can generate only six notes at a time.

The Polaris contains 132 programs, numbered internally 1 through 132. The MIDI Specification only allows program numbers up to 127. Thus, the Polaris MIDI Implementation cannot access programs K8 through K12.

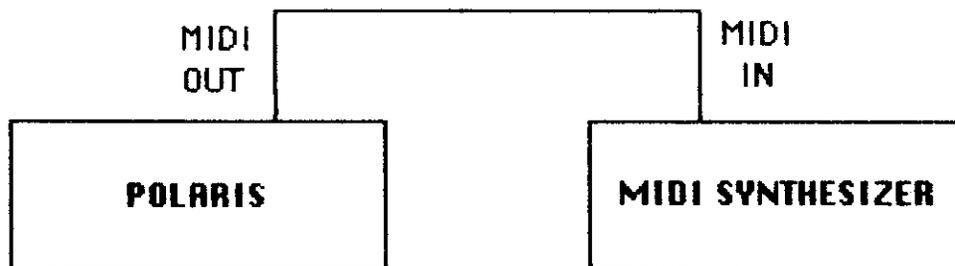
The Polaris MIDI has two modes of operation. When connected to another Polaris, or to a computer that specifically understands the Polaris, program changes and parameter changes can be transmitted and received. When connected to a different kind of instrument, transmission and reception of this information is suppressed.

The Polaris MIDI allows a controlling computer to read and write programs and sequences in the Polaris' memory. It also allows the internal workings of the Polaris to be tapped into in unusual ways. Details are provided in a separate technical manual, which can be requested from your Fender dealer.

#### Connecting the Polaris

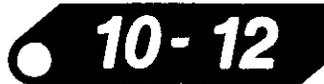
The rear panel includes two MIDI connectors, labelled IN and OUT.

As you might expect, connecting two MIDI devices together involves attaching a cable between the OUT of the controlling device (the master) and the IN of the controlled device (the slave).



Some versions of the MIDI provide a third connector, labelled THRU, that provides a buffered copy of whatever comes in the IN connector, allowing multiple instruments to be daisy-chained together (hooked together in sequence). In the Polaris, the OUT connector doubles as a THRU connector under software control. If the Polaris is used to transmit MIDI data, including possibly MIDI synchronizing clocks, the OUT connector will be in Out mode. If all Polaris MIDI outputs are disabled, the connector automatically enters Thru mode.

If you want to use the Polaris to communicate bidirectionally with another device (either a computer or another instrument), you will need to connect the Polaris IN to the other device's OUT and connect the Polaris OUT to the other device's IN. Then you will have to configure the Polaris to generate the appropriate output; this will put its output into the Out mode.



If you want to daisy-chain a number of Polaris and/or other MIDI instruments together and use the Polaris for receiving only, you will need to connect the IN to the previous device's OUT and connect the OUT to the next device's IN. Then you will have to configure the Polaris so it generates no output; this will put its output into Thru mode.



If you want to daisy-chain instruments AND have the Polaris able to transmit back to the controlling device, you will have to put the Polaris at the end of the chain. Obviously, you can only do this with one Polaris.

#### The MIDI Mode Switches

The Polaris MIDI has a fairly large number of configurable options. Some are a bit obscure, but those generally need to be set up once. The first things to configure are the MIDI Mode Switches.

#### LOWER FUNCTION, CASSETTE, 8 - MIDI Panel Switch

This software switch tells the Polaris whether its MIDI is to receive and transmit control panel related information, including Program Change commands.

#### LOWER FUNCTION, CASSETTE, 9 - MIDI Omni Mode

This software switch tells the Polaris whether its MIDI is to ignore MIDI channel numbers.

#### LOWER FUNCTION, CASSETTE, 10 - MIDI Mono Mode

This software switch tells the Polaris whether to play keyboard information received from the MIDI monophonically.

Pressing any of these switches causes its LED and corresponding mode to toggle off or on. The MIDI Panel Switch will always retain its state when the power is turned off. Turning the power off, though, always turns Omni Mode on and the Mono Mode off.

The MIDI Panel Switch should be turned on only when connected to another Polaris or to a computer that can understand Polaris program and parameter numbers. If you leave this on when connected to some other instrument, the Polaris program and parameter changes will possibly confuse the other instrument.

The MIDI Omni Mode causes all MIDI channel numbering to be ignored. This mode is provided so you can play two synthesizers in parallel without having to worry about setting the MIDI channel numbers on the instruments. It is, however, an inferior method of using the interface. To get the most from the Polaris MIDI, you should turn this off, and use the MIDI channel assignment capability described below. This is turned on when the power is shut off because the official MIDI Specification says it should be.

The MIDI Mono Mode affects the way RECEIVED keyboard information is processed; it has no affect on notes played on the Polaris' own keyboard, or on information transmitted by the Polaris. Normally it should be left off (Poly Mode). When turned on, incoming keyboard information on each channel will be played monophonically; that is; all keyboard information coming in on a particular MIDI channel will be played by a single voice within the Polaris. This might be useful if you are using a device such as a guitar controller, which would transmit monophonic information on six MIDI channels.

#### MIDI Channel Assignment

The MIDI Specification defines 16 data channels for MIDI information. These channels are numbered from 1 through 16. Most MIDI instruments can only send and receive on one channel at a time, so selecting the channel is a simple matter of choosing the channel number. The Polaris can transmit or receive on more than one channel at a time, so the user must select what is known as the Basic Channel number, and tell the Polaris how many channels it is to respond to or transmit on.

#### Setting the Basic Channel Number

Since the Polaris doesn't have a set of sixteen switches to select the channel number, another method must be used. Switches 1 through 6 are used to select the Basic Channel number; the selected channel is the SUM of all the switches that are turned on. Channels 1 through 6 can be accessed by turning on just one of the switches, while higher channels require multiple switches. For instance, to select channel 14 as the Basic Channel number, you might use switches 6, 5, and 3. Pressing a switch toggles it on and off. Since the Basic Channel number will be remembered when you shut the power off, you probably will have to set it only once.

The scale of channel numbers is considered circular; therefore, if you have no switches on, the channel before channel 1 will be selected, and this is channel 16. If you have a combination of switches adding up to something greater than 16, 16 will be subtracted from the sum of the switches.

There are three primary data streams in the Polaris. These are the Main, the Link and the Sequencer. When you set the Basic Channel number to  $b$ , the Main data stream corresponds to channel  $b$ , the Link corresponds to channel  $b+1$ , and the Sequencer corresponds to channel  $b+2$ .

#### MIDI Extra Channels

If you are using the MIDI to receive information and you want to use internal data streams other than the Main, Link, or Sequencer data streams, you must tell the MIDI how many extra channels to use.

- LOWER FUNCTION, MIDI CHANNEL, 7 - No extra channels are used.
- LOWER FUNCTION, MIDI CHANNEL, 8 - Channel  $b+3$  is used.
- LOWER FUNCTION, MIDI CHANNEL, 9 - Channels  $b+3$  and  $b+4$  are used.
- LOWER FUNCTION, MIDI CHANNEL, 10 - Channels  $b+3$ ,  $b+4$ , and  $b+5$  are used.
- LOWER FUNCTION, MIDI CHANNEL, 11 - Channels  $b+3$  through  $b+6$  are used.
- LOWER FUNCTION, MIDI CHANNEL, 12 - Channels  $b+4$  through  $b+7$  are used.

Remember that the scale of MIDI channel numbers is circular; if the Basic Channel number *b* is set to, for example, 12, and you use all the MIDI Extra Channels, the Main, Link, and Sequencer channels will be 12, 13, and 14, and the extra channels will be numbers 15, 16, 1, 2, and 3. Pressing one of switches 7 through 12 will select the number of MIDI extra channels.

Data received on the MIDI Extra Channels will be completely independent of, and will not interfere with, the normal use of the instrument's keyboard and sequencer, barring competition for the six available voices in the Polaris. If you send data into the MIDI on the Main, Link, or Sequencer channel, it will be mixed in with whatever you play on the keyboard or the sequencer. If you do not intend to use the keyboard or sequencer, you can use those channels through the MIDI.

The number of MIDI Extra Channels is remembered when you shut off the power.

#### Data Stream Routing

This is the configuration you will perform most often, so you will probably memorize it. There are twelve internal data streams that can each be turned on and off. The term "Local" refers to the internal sound generation of the Polaris. If LOWER FUNCTION, INTERFACE, 3 is off, the Sequencer will not be played through the Polaris channels.

LOWER FUNCTION, INTERFACE, 1 - The Main Local Control Switch is toggled.  
LOWER FUNCTION, INTERFACE, 2 - The Link Local Control Switch is toggled.  
LOWER FUNCTION, INTERFACE, 3 - The Sequencer Local Control Switch is toggled.  
LOWER FUNCTION, INTERFACE, 4 - The Main Chroma Out Switch is toggled.  
LOWER FUNCTION, INTERFACE, 5 - The Link Chroma Out Switch is toggled.  
LOWER FUNCTION, INTERFACE, 6 - The Sequencer Chroma Out Switch is toggled.  
LOWER FUNCTION, INTERFACE, 7 - The Main MIDI In Switch is toggled.  
LOWER FUNCTION, INTERFACE, 8 - The Link MIDI In Switch is toggled.  
LOWER FUNCTION, INTERFACE, 9 - The Sequencer MIDI In Switch is toggled.  
LOWER FUNCTION, INTERFACE, 10 - The Main MIDI Out Switch is toggled.  
LOWER FUNCTION, INTERFACE, 11 - The Link MIDI Out Switch is toggled.  
LOWER FUNCTION, INTERFACE, 12 - The Sequencer MIDI Out Switch is toggled.

The Local Control Switches selectively allow the Main, Link, and Sequencer information to go to the internal instruments. The Chroma Out Switches are described in Chapter 11. The MIDI In Switches allow the MIDI to receive on channels *b*, *b*+1, and *b*+2 respectively. The MIDI Out Switches allow the MIDI to transmit on channels *b*, *b*+1, and *b*+2 respectively. Pressing any one of these switches toggles the parameter on and off.

Switch number 1 should generally be left on. If it is off and you select a program with a link, the link will not get set up. Also, keyboard splits will not work properly. This is because all link-related information comes from the parameters in the Main Workspace, and when switch 1 is off program changes never get to the Main Workspace.

If you want part of the sound to play internally and another part to be sent out to another instrument, you should have the Main sound play internally and use the other instrument for the other sound. For instance, you might turn on LOWER FUNCTION, INTERFACE, 1, 2, and 12. This will cause the Main and Link sounds to play internally while the Sequencer transmits information on MIDI channel b+2.

If you want to layer sounds, you can send the same data stream to more than one place. If LOWER FUNCTION, INTERFACE, 1,4, and 10 are all on, the Main sound will be played internally and sent out over both the Chroma and the MIDI.

The MIDI In Switches are provided in case you want to restrict the Polaris to receive on fewer than three channels. This would be valuable if you have a number of instruments daisy-chained, and fifteen (for example) of the sixteen channels are in use by other instruments; in this case, you would have to turn off all but one of these in order to prevent the Polaris from responding to information not addressed to it.

If the Sequencer MIDI In switch is on, this allows incoming information to be interpreted by the sequence channel. This "instrument" is not recorded by the sequencer, but is played by the sequencer when a sequence is played. The sequencer always records the main instrument data, whether it comes from the keyboard, the Chroma Interface, or the MIDI.

The MIDI Out Switches (along with the MIDI clock output, described below) determine the operating mode of the output connector. If none of the MIDI Out Switches are on (and the MIDI clock output is not in use) the connector will function in Thru mode. When you turn on any of the MIDI Out Switches, the connector switches to Out mode.

When the power is first turned on, the Local Control Switches will be on and the MIDI Out Switches will be off. This means the output connector powers up in the Thru mode. The MIDI In Switches retain their state when the power is turned off.

#### Sending a Program

If you have two Polaris connected you can send the program in the Main Workspace of one Polaris to the Main Workspace of the other. On the sending Polaris, press LOWER FUNCTION, CASSETTE, 12; the program will be sent to the other Polaris. From there, it can be manually stored someplace in memory. This works even if the MIDI Panel Switch is off. Remember to press LOWER FUNCTION again to return the panel to its normal operation.

### Synchronizing Via the MIDI

Chapter 14 covers the Sync Interface, and includes instructions on configuring the metronome so it is synchronized with an external device as either a master or a slave or both. Certain synchronizing modes use the MIDI clock input and/or the MIDI clock output. The MIDI is capable of sending and receiving timing information that allows, among other things, the sequencers in two Polarises to run concurrently. Refer to Chapter 14 and select the appropriate mode. If you have two Polarises, set up one to transmit MIDI timing information and the other to receive it.

When you select a metronome configuration that causes MIDI clocks to be transmitted, you will automatically put the output into Out mode. This will also enable the transmission of Start and Stop signals whenever you put the sequencer into Play or Stop mode. When you select a metronome configuration that allows MIDI clocks to be received, reception of the Start and Stop signals will be enabled, and will cause the sequencer to be started and stopped.

When you operate two Polaris sequencers in tandem, you will still have to select the sequence to be played on each instrument. This is because there isn't necessarily a one-to-one correspondence between the sequences. For instance, one Polaris may play a chain of several short sequences while the other plays a single long sequence.



## CHAPTER 13/MIDI IMPLEMENTATION

### MIDI Implementation

The internal architecture of the Polaris has three primary sources of musical event data:

**Main** -- This generates information from the entire keyboard, or part of the keyboard if it is split. It generates information from the various performance inputs (levers, pedal, and footswitch). It also generates program changes and parameter changes.

**Link** -- This generates keyboard information and performance control information, but only if a link is in effect. It can also generate program changes when a link is set up or cleared, and can generate parameter changes if the Edit Link function is invoked on the control panel.

**Sequencer** -- This generates all information when a sequence is played.

The implementation of the MIDI in the Polaris is distinguished by the following characteristics:

There are three software switches, called the MIDI Input Switches, that selectively enable reception on each of the three channels. There are three more software switches, call the MIDI Output Switches, that selectively enable transmission on each of the three channels.

There are three switches, call the Local Control Switches, that selectively enable the internal data flow on these channels. There are also three switches, called the Chroma Out Switches, that selectively enable transmission of each channel over the Chroma Interface.

There is a software switch, called the MIDI Panel Switches, that determines how much information is received and transmitted over all the MIDI channels. When off, control-panel related information, specifically program changes and parameter changes, are filtered out of all MIDI input and output. When on, this information is received and transmitted normally. This switch should be off if the Polaris is communicating directly with a different type of instrument. It should be on if the Polaris is connected to another Polaris, or to a computer that understands the Polaris panel information. There is a similar switch for the Chroma Interface.

The Main Instrument is set up at all times, unless it has been explicitly deleted through the MIDI or the Chroma Interface. The Link instrument is created whenever a link is set up, and deleted whenever the link is cleared. The Sequencer instrument is created whenever a sequence is played, and deleted when the sequence is stopped.

Instruments 3 through 7 don't exist until they are created through the MIDI or the Chroma Interface. This implies that the MIDI Panel Switch must be on if the Extra MIDI Channels are to be used, as it is

necessary to select a non-zero program for a channel before it will respond to notes.

The Polaris MIDI supports Poly, Mono, Poly/Omni, and Mono/Omni modes. The system always powers up in the Poly/Omni mode; the mode can be changed from the panel as well as through the MIDI.

When either Omni Mode is in effect, information received on all 16 MIDI channels is routed to the Main Instrument. Information from the Main, Link, and Sequencer sources will be transmitted on channel b. Note that if a Link Unison is in effect, each performance event will be sent in duplicate, as the Main and Link information will both come out on channel b.

When either Mono Mode is in effect, received Note On messages are assigned to voices with a different algorithm than when Poly Mode is in effect. This algorithm causes a single voice to be used repeatedly. This does not affect notes played on the same logical instrument from the keyboard, sequencer, or Chroma Interface. This differs slightly from the conventional interpretation of the MIDI Mono Mode. In particular, there is no fixed relationship between voices and channels in Mono Mode. Playing polyphonically in the keyboard can still steal voices that have been played monophonically through the MIDI. The only effect the Mono Mode has is that MIDI Note On commands will be directed to the most recently played voice that is already allocated to the correct logical instrument, instead of looking for the oldest released voice.

Mono Mode has no effect on transmission. When Mono Mode is selected, all MIDI input channels are placed in Mono Mode.

Each input channel programmed to receive MIDI input responds to Mode Change commands. There is, however, only one global mode for the whole Polaris, rather than a separate mode for each channel. Therefore, it doesn't matter which of the channels receives the Mode Change. If Omni Mode is in effect, a Mode Change will be acted on regardless of what channel it is received on.

The MIDI standard does not allow enough Control Change numbers to cover all the parameters in the Polaris, so some of the undefined Control Change numbers have been appropriated. As stated before, though, parameter changes are only received and transmitted if the MIDI Panel Switch is on.

The internal metronome that runs the sequencer can be synchronized to received MIDI clocks, and can also generate MIDI clocks. The MIDI clock interface can be used concurrently with the Sync Interface. For instance, the metronome can be slaved to the MIDI clock input and can generate a sync output. Alternatively, it can be slaved to the sync input and generate a MIDI clock output (in addition to a sync output at a different ratio, if desired). It is best, though, to use the internal metronome as the master, as this allows the metronome's tempo footswitch to set the tempo for the entire system.

The sequencer Stop and Start functions are implemented. They are transmitted only when the MIDI clock output is being used, and are interpreted when received only when the MIDI clock input is being used. The Continue, Song Position Pointer, and Song Select functions are not implemented.

The physical interface uses two connectors, one for MIDI IN and the other for both MIDI OUT and MIDI THRU, selectable by the user. The MIDI output is in Thru mode if all MIDI Output Switches are off and the MIDI clock output is disabled; it is in Out mode if any MIDI Output Switch is on or if the MIDI clock output is enabled. The output can also be placed into Out mode through the use of a System Exclusive command.

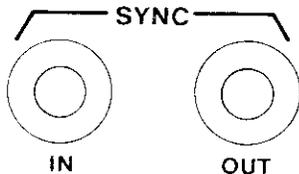
All configuration parameters are non-volatile, except that the MIDI Output Switches are always turned off, the Local Control Switches are turned on and the MIDI Mode is set to Poly/Omni whenever the power is turned on (or whenever a MIDI Reset is received).



## CHAPTER 14/THE SYNC INTERFACE

### SYNC INTERFACE

The Polaris includes the capability of synchronizing its internal metronome with an external drum machine or other device. There are two 1/4" phone jacks on the rear panel for this purpose.



The internal metronome can be slaved to the SYNC IN if an external device is to provide the tempo, or an external device can be slaved to the SYNC OUT if the internal metronome is to be used.

The SYNC IN and SYNC OUT jacks are electrically connected in parallel with the input and output pins of the cassette interface DIN connector. It is important not to connect a cassette machine to the Polaris at the same time you are using the SYNC IN jack, or the output of the cassette machine will fight with the output of the drum machine. If you need to perform a cassette operation while using the Sync Interface, temporarily unplug the SYNC IN until you have finished with the cassette.

The first step to using the Sync Interface is to study the manual for the device you wish to connect. You must find out the following information:

How many clocks per beat does the device use? Twenty-four is the most common.

What is the signal level the device puts out? This is only important if the Polaris metronome is to be the slave and the external device is to be the master.

What is the signal polarity the device uses? In other words, does it clock on the positive edge or the negative edge?

What is the absolute maximum rate the device can be clocked at? This is only important if the metronome is to be the master and the external device is to be the slave. You will probably need to determine this empirically; the procedure is described below.

NOTE: When interfacing the Polaris with an Oberheim DX or DMX, a machine end of the cable. All other machines that respond to gated clock signals should be compatible with the Polaris.

The Sync Interface must then be configured. There are three configuration "menus" relating to the Sync Interface, one for setting up the input, the second for setting up the output, and the third for the metronome.

#### Sync Input Configuration

If you are using the SYNC IN to slave the metronome to an external device (such as a drum machine controlling the Polaris), press LOWER FUNCTION, SYNC INPUT. The LEDs on 1-5 will show the correct Sync Interface input clock ratio, and the 1-5 switches can also be used to change it.

LOWER FUNCTION, SYNC INPUT, 1 - 12 clocks per beat  
LOWER FUNCTION, SYNC INPUT, 2 - 24 clocks per beat  
LOWER FUNCTION, SYNC INPUT, 3 - 48 clocks per beat  
LOWER FUNCTION, SYNC INPUT, 4 - 96 clocks per beat  
LOWER FUNCTION, SYNC INPUT, 5 - 192 clocks per beat

Additionally, you can review or change the input polarity and input threshold.

LOWER FUNCTION, SYNC INPUT, 6 - If this LED is off, the Sync Interface input is triggered on the rising edge of the input signal. Most drum machines produce such a signal. If this LED is on, the Sync Interface input is triggered on the falling edge of the input signal. Pressing 6 switch toggles this back and forth.

LOWER FUNCTION, SYNC INPUT, 12 - If this LED is off, the Sync Interface input responds to signals symmetrical about zero volts. If this LED is on, the Sync Interface input has a threshold of 1.5 Volts. Pressing 12 toggles this back and forth.

After you have completed this configuration, press LOWER FUNCTION again to return the panel to normal operation. The configuration will be remembered when the power is turned off, so you will not need to repeat this procedure unless you change the configuration.

NOTE: If when using the Sync Input (or Output) with a drum machine the drum machine is playing too fast or too slow in relation to the Polaris metronome, try using a different clock rate. Don't be afraid to experiment.

#### Sync Output Configuration

If you are using the SYNC OUT to slave a drum machine to the metronome (the Polaris is controlling the drum machine), press LOWER FUNCTION, J. The LEDs on 1-5 will show the correct Sync Interface output clock ratio, and the 1-5 switches can also be used to change it.

LOWER FUNCTION, SYNC OUTPUT, 1 - 12 clocks per beat  
LOWER FUNCTION, SYNC OUTPUT, 2 - 24 clocks per beat  
LOWER FUNCTION, SYNC OUTPUT, 3 - 48 clocks per beat  
LOWER FUNCTION, SYNC OUTPUT, 4 - 96 clocks per beat  
LOWER FUNCTION, SYNC OUTPUT, 5 - 192 clocks per beat

Additionally, you can review or change the output polarity or the output limit rate.

LOWER FUNCTION, SYNC OUTPUT, 6 - The Sync Interface output produces a square wave. If this LED is off, the rising edge will fall on the beat. Most drum machines expect such a signal. If this LED is on, the falling edge will fall on the beat. Pressing 6 toggles this back and forth.

When using the footswitch to set the beat, the metronome is often forced to jump forward a fraction of a beat. When this happens, the Sync Interface output sends a burst of rapid sync pulses to the external device. If your external device keeps time when given a steady beat, but loses time when you use the footswitch, try a lower burst rate (a higher number). Setting this too low may cause problems at high tempi.

LOWER FUNCTION, SYNC OUTPUT, 7 - 1200Hz. (Try this setting first.)  
LOWER FUNCTION, SYNC OUTPUT, 8 - 600Hz.  
LOWER FUNCTION, SYNC OUTPUT, 9 - 400Hz.  
LOWER FUNCTION, SYNC OUTPUT, 10 - 300Hz.  
LOWER FUNCTION, SYNC OUTPUT, 11 - 200Hz.  
LOWER FUNCTION, SYNC OUTPUT, 12 - 150Hz.

After completing this configuration, press LOWER FUNCTION again to return the panel to normal operation. The configuration will be remembered when the power is turned off, so you will not need to repeat this procedure unless you change the configuration.

#### Metronome Configuration

You must tell the Polaris which device will be the master. Several combinations are possible, and are selected by pressing LOWER FUNCTION, METRONOME as a prefix. The LEDs on 1-12 will show the correct Sync Interface metronome configuration, and the 1-12 switches can also be used to change it.

LOWER FUNCTION, METRONOME, 1 - Internal only. The internal metronome operates normally, and no external syncing is provided.

LOWER FUNCTION, METRONOME, 2 - Master to sync. The Polaris metronome is the master, and the Sync Interface output produces sync pulses.

LOWER FUNCTION, METRONOME, 3 - Master to MIDI. The Polaris metronome is the master, and the MIDI Interface output produces timing bytes. For more information, see the section on the MIDI Interface.

LOWER FUNCTION, METRONOME, 4 - Master to sync and MIDI. The metronome is the master, the Sync Interface output produces sync pulses, and the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 5 - Slave from sync. The Polaris metronome is slaved to the Sync Interface input.

LOWER FUNCTION, METRONOME, 6 - Slave from sync to sync. The metronome is slaved to the Sync Interface input, and the Sync Interface output produces sync pulses. If the sync input and output clock ratios are different, the Polaris will convert the incoming ratio to the outgoing ratio, allowing otherwise incompatible devices to be used in the same system. This is useful for using an external device to control the Polaris and another sequencer or drum machine.

LOWER FUNCTION, METRONOME, 7 - Slave from sync to MIDI. The metronome is slaved to the Sync Interface input, and the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 8 - Slave from sync to sync and MIDI. The metronome is slaved to the Sync Interface input, the Sync Interface output produces sync pulses, and the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 9 - Slave from MIDI. The metronome is slaved to the timing bytes coming in through the MIDI Interface.

LOWER FUNCTION, METRONOME, 10 - Slave from MIDI to sync. The metronome is slaved to the MIDI Interface input, and the Sync Interface output produces sync pulses.

LOWER FUNCTION, METRONOME, 11 - Slave from MIDI to MIDI. The metronome is slaved to the MIDI Interface input, and the MIDI Interface output relays the timing bytes.

LOWER FUNCTION, METRONOME, 12 - Slave from MIDI to sync and MIDI. The metronome is slaved to the MIDI Interface input, the Sync Interface output produces sync pulses and the MIDI Interface output relays the timing bytes.

After you have completed this configuration, press LOWER FUNCTION again to return the panel to normal operation. This configuration will not be remembered when you turn the power off. When the Polaris is first turned on, LOWER FUNCTION, METRONOME, 1 is automatically selected.

#### Using the Metronome As the Master

When the metronome is used as the master for controlling a drum machine (or a MIDI device), the Tempo Tap feature is available. The ability to tap out a beat thus extends to other devices besides the Polaris. The footswitch can also be used to start other devices, as the Sync Interface output produces no sync pulses when the metronome is stopped.

#### Using the Metronome As a Slave

When the metronome is used as a slave, the ability to tap out a beat on the footswitch is lost. However, the footswitch does have one remaining function. If you press the STOP switch while in Stop mode, the metronome will be stopped even if sync pulses are still coming in from the drum machine. As soon as you press the footswitch, the

metronome will start following the Sync Interface input. Normally, though, you use the capability of the drum machine to start and stop its own sync output.

#### Syncing Two Polarises

When connecting the Sync Interface output of one Polaris to the Sync Interface input of another, you can lock the two metronomes together. These are the settings you would use:

#### MASTER POLARIS SETTINGS

LOWER FUNCTION, SYNC OUTPUT, 3 - This sets the output to 48 clocks per beat, the Polaris' internal standard.

LOWER FUNCTION, SYNC OUTPUT, 6 - (LED 6 off) This specifies positive edge triggering.

LOWER FUNCTION, SYNC OUTPUT, 7 - This allows a 1200Hz sync output.

LOWER FUNCTION, METRONOME, 2 - This tells the Polaris to use its metronome as the master and generate a sync output.

#### SLAVE POLARIS SETTINGS

LOWER FUNCTION, SYNC INPUT, 3 - This sets the input to 48 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 6 - (LED 6 off) This specifies positive edge triggering.

LOWER FUNCTION, SYNC INPUT, 12 - This specifies a zero volt threshold.

LOWER FUNCTION, METRONOME, 5 - This tells the Polaris to slave its metronome to its Sync Interface input.



## CHAPTER 15/ADJUSTING THE POLARIS

### INSTRUMENT ADJUSTMENT

#### Tuning

There are various adjustments in the Polaris performed with the help of the Polaris' computer. The most important adjustment, and perhaps the only one the user will ever need to perform, is the tuning process. When turned on, the instrument does not automatically tune itself. Rather it remembers how it was tuned when last turned off. In many cases, the tuning may still be fine. If the instrument is at a different temperature, though, it will probably need tuning.

LOWER FUNCTION, TUNE ALL - This sequence asks the Polaris to tune itself, a process that takes about eight seconds. You can interrupt a tuning by pressing LOWER FUNCTION again.

Occasionally during a performance, you will find a single channel sounds a bit out of tune.

UPPER FUNCTION, TUNE ONE - This sequence asks the Polaris to tune only the most recently played channel.

If a channel cannot be tuned, it will automatically be removed from operation. You will notice, then, that you have only five channels to play with. If this happens, always retry the tuning sequence, in case the problem was a "fluke."

#### Click Volumes

The Polaris includes provisions for adjusting the volume of the metronome click, the switch press click and the error honk. These are all set in the adjustment mode. The switch sequence determines which parameter is to be set, and the MASTER slider completes the actual adjustment.

LOWER FUNCTION, ADJUSTMENTS, 1 - Stop mode click volume.  
This adjusts the volume of the metronome click when the sequencer is in the Stop mode. Typically, you will leave this all the way down, but it may prove useful to raise the click volume if you wish to practice with the metronome prior to recording.

LOWER FUNCTION, ADJUSTMENTS, 2 - Record mode click volume  
This adjusts the volume of the metronome click when the sequencer is in the Record mode. You don't have to be in Record mode to adjust this. Typically, you will leave this fairly high.

LOWER FUNCTION, ADJUSTMENTS, 3 - Play mode click volume  
This adjusts the volume of the metronome click when the sequencer is in Play mode. You don't have to be in Play mode to adjust this. Typically, you should leave this all the way down, but you may wish to turn it up while practicing.

LOWER FUNCTION, ADJUSTMENTS, 4 - Switch press click volume  
This adjusts the volume of the click you hear whenever you press a switch. Typically, you should leave this all the way down, but you

may wish to turn it up while programming the instrument. To hear the click while adjusting the volume with the MASTER slider, press switch number 4 repeatedly.

#### LOWER FUNCTION, ADJUSTMENTS, 5 - Error honk volume

This adjusts the volume of the honk you hear when the memory fills up, or when you request an impossible operation. To hear the honk while adjusting this volume with the MASTER slider, press switch number 5 repeatedly.

When you have finished all adjustments, press LOWER FUNCTION again to restore the panel to its normal operation.

#### Factory Adjustments

Certain internal aspects of the Polaris cannot be adjusted by the instrument alone, and need the user's help. Typically, these things are adjusted at the factory and never need adjusting again. However, it is useful to be aware of them, just in case you need to perform them in a pinch. These use the same adjustment mode described previously. Each adjustment requires you to perform certain manual steps, and perhaps listen to the results.

#### LOWER FUNCTION, ADJUSTMENTS, 7 - Mechanical lever range

If either lever doesn't return to zero properly, or go all the way in one direction or the other, or has an excessive dead zone at one end, select this adjustment. Make sure the levers are in their center positions when you first select this adjustment, as the computer records their positions at this time. Then simply move both levers through their entire mechanical ranges. The computer will record how far each moved in each direction and will use its recordings as a reference against which all lever action is measured in the future.

#### LOWER FUNCTION, ADJUSTMENTS, 8 - Mechanical pedal range

If the optional pedal doesn't cover the expected range or seems to have a large dead zone at either end, select this adjustment and move the pedal through its entire mechanical range. This should be done when you first connect your pedal or if you ever change pedals.

#### LOWER FUNCTION, ADJUSTMENTS, 9 - Volume offset

Each VCA (Voltage Controlled Amplifier) has an offset that must be trimmed out. When misadjusted, the volume envelope will sound oddly truncated. Before entering this mode, you should select a scratch sound from an empty memory slot. You must also preset the volume.

Use the ASSIGNABLE CONTROL to set the VOLUME parameter to about 1/4, and turn the MASTER slider all the way up. After entering LOWER FUNCTION, ADJUSTMENTS, 9, strike and release any key and raise the MASTER slider until you hear the note just begin to bleed through, then back the slider off carefully until the note just disappears. Repeat this procedure five more times on five more notes to adjust all the remaining voices. At any time, you can reset all the thresholds to their nominal (but not necessarily correct) levels by pressing number switch 9 a second time.

#### LOWER FUNCTION, ADJUSTMENTS, 10 - Key sensitivity

If one or more keys feels excessively sensitive or not sensitive enough, select this adjustment and play the key repeatedly. The slider in the MASTER section can then be used to adjust its sensitivity over a moderate range. Obviously, you must have a touch-sensitive program selected before you enter this mode. If you get everything out of whack, you can always reset the entire keyboard to its nominal sensitivity by pressing number switch 10 a second time.

When all adjustments are complete, again press LOWER FUNCTION to return the instrument to normal operation. If, during the adjustment procedure, you wish to select a different sound, you must exit the adjustment mode, make your selection, and then reenter the adjustment mode, as described above.

#### Default Settings

Whenever you turn the Polaris on, certain default settings will always come on. You will soon notice the Polaris always remembers the settings and the tuning you were using when you shut it off. Additionally, the following switches are set automatically when power is supplied:

LOWER FUNCTION, INTERFACE, 1  
LOWER FUNCTION, INTERFACE, 2  
LOWER FUNCTION, INTERFACE, 3  
LOWER FUNCTION, CASSETTE, 9  
LOWER FUNCTION, METRONOME, 1  
LOWER FUNCTION, MIDI CHANNEL, 1  
LOWER FUNCTION, MIDI CHANNEL, 7



## CHAPTER 16/POLARIS PATCHES

### PATCHES

#### Bank A - Assortment 1

- 1 - Percussive pulse
- 2 - Chorus
- 3 - Clavinet
- 4 - Strings
- 5 - Brass I
- 6 - Organ
- 7 - Circus synthesizer
- 8 - Guitar
- 9 - Phase sync
- 10 - Slow sweep
- 11 - Brite wow
- 12 - Organsinette

#### Bank B - Assortment 2

- 1 - String section
- 2 - Vibes I
- 3 - Quick sweep
- 4 - Electric owls
- 5 - Brite crescendo
- 6 - Mellow funk
- 7 - Release envelope
- 8 - Toy Polaris
- 9 - Chipmonks
- 10 - Slow echo
- 11 - Wooden pop
- 12 - Organo

#### Bank C - Strings/Brass

- 1 - High strings
- 2 - Violin
- 3 - Slow attack strings
- 4 - Phased strings
- 5 - Percussive strings
- 6 - Mellow cello
- 7 - Brass II
- 8 - Flanged brass
- 9 - Buzzy brass
- 10 - Phased brass
- 11 - Metallic brass
- 12 - Vibrato brass

#### Bank D - Piano/Organ

- 1 - Electric piano I
- 2 - Electric piano II
- 3 - Phased piano
- 4 - Percussive piano
- 5 - Brite piano
- 6 - Percussive organ
- 7 - Slow B3
- 8 - Fast B3

- 9 - Tracker organ
- 10 - Phased organ
- 11 - Pipe organ
- 12 - Vibrato organ

Bank E - Harpsichord/Clavinet

- 1 - Harpsichord I
- 2 - Harpsichord II
- 3 - Harpsinette
- 4 - Harp
- 5 - Brite clavinet
- 6 - Chorus clavinet
- 7 - Mellow clavinet
- 8 - Fat clavinet
- 9 - Clavinet with wah
- 10 - Clavinet with wow
- 11 - Vibes II
- 12 - Celeste

Bank F - Percussive/Pluck

- 1 - Sharp saws
- 2 - Percussive synthesizer
- 3 - Percussive Polaris
- 4 - Percussive fifths
- 5 - Percussive sweep
- 6 - Percussive vibrato
- 7 - Brite percussion
- 8 - Percussive chorus
- 9 - Baritone uke
- 10 - Sitar-ish
- 11 - Banjo
- 12 - Mellow bass guitar

Bank G - Orchestra

- 1 - Mellow clarinet
- 2 - Fat clarinet
- 3 - Electric clarinets
- 4 - Flutes
- 5 - Digital recorder
- 6 - Reeds
- 7 - Bassoon
- 8 - Digital bassoon
- 9 - Metallic saxes
- 10 - Liquified Brass
- 11 - Concertina
- 12 - Music box

Bank H - Sweeps/Sync

- 1 - Power sweep
- 2 - Sweeping pulse
- 3 - Sync saws
- 4 - Percussive wow
- 5 - Multi-sweep

- 6 - Resonance sweep
- 7 - Brite sweep
- 8 - Grand swell
- 9 - Octave sync
- 10 - Sliding sync
- 11 - Friend's synthesizer
- 12 - Percussive sync

Bank I - Synthesizer sounds

- 1 - Big Pulse
- 2 - Brite pulse
- 3 - Vibrato pulse
- 4 - Inverted pulse
- 5 - Wah release
- 6 - Ring modulated wow
- 7 - Ring modulated metal
- 8 - SFZ
- 9 - Brite echo
- 10 - Octave echo
- 11 - Falling echo
- 12 - Trilling fifths

Bank J - Special effects

- 1 - Helicopter I
- 2 - Helicopter II
- 3 - Waves
- 4 - Wind
- 5 - Percussive noise
- 6 - Tuned drums
- 7 - Steel drums
- 8 - Birdies
- 9 - Falling Polaris
- 10 - Outer space
- 11 - Long falls
- 12 - Bombers (play E below middle C)

Bank K - Link Sounds

- 1 - Fifths
- 2 - Jazz Polaris (unison)
- 3 - Drums (J5 unison J6)
- 4 - Strings/Harpsichord (A4 unison E2)
- 5 - Percussive sweep/Friend's synthesizer (F5 unison H11)
- 6 - Echo/Organo (B10 upper B12)
- 7 - Bass/Piano (F12 upper D2)
- 8 - Sweep/Circus synthesizer (H1 upper A7)
- 9 - Clavinet/Vibrato Brass (E6 upper C12)
- 10 - Sweep/Strings (B3 upper C4)
- 11 - Percussive chorus/B3 (F8 unison D7)
- 12 - Sweep/Echo (H5 unison I11)

## SEQUENCES

### Bank F

- 7 - Bass line. Loops to itself.
- 8 - Chains to 9.
- 9 - Chains to 8.
- 10 - Bass line. Loops to itself.
- 11 - Rock 'n' Roll rhythm. Loops to itself.
- 12 - "Mother-In-Law". Loops to itself.

## CHAPTER 17/TROUBLESHOOTING

### TROUBLESHOOTING

#### What to do When Things Don't Work

Every once in awhile you will run into a situation when your Polaris won't seem to work. In most of these cases, simply selecting another sound or resetting the Polaris will clear up the problem.

For example, if the footswitches are plugged in after the Polaris has been turned on, they will work backwards (that is, the off position will be the on position). A LOWER FUNCTION, RESET, or turning the power off and then on again will correct this situation.

When using the MIDI, if the Polaris receives a Program Change = 0 it undefines the Polaris instrument that is listening to that command. If you are in OMNI Mode when this Program Change is received, all sound will stop. In this case, reselect a program.

When editing the sound in the workspace, if the sliders and switches don't seem to be making any difference in the sound check to see if you are editing the wrong half of a linked sound. Normally, the sliders and switches will affect the main sound only. To edit the link sound, you must press LOWER FUNCTION, EDIT LINK.

Cassette loading operations are all on the right side of the control panel, so if you run out of memory you might not notice the MEMORY FULL LED on the extreme left. If you have a problem when loading information from a cassette, remember to look at this LED, as it will flash only for a moment.

While you are in EDIT LINK mode, you will notice that the letter and number switches show what program is linked to. This is for your information only, as you cannot select a new link by pressing a number switch.

#### Radio/TV Interference

You can determine whether your synthesizer is causing interference by turning it off. If the interference stops, it was probably caused by the synthesizer or its peripheral devices.

You can further isolate the problem by disconnecting the peripheral devices and their input/output (I/O) cables one at a time, starting with pedals and footswitches. If the interference stops, it is caused by either the peripheral device or its I/O cable. These devices usually require shielded I/O cables. For Fender peripheral devices, you can obtain the proper shielded cable from your dealer. For non-Fender peripheral devices, contact the manufacturer or dealer for assistance.

If your synthesizer does cause interference to radio or television reception, you can try one or more of the following measures to correct it:

- a) Turn the television or radio antenna until the interference stops.

- b) Move the synthesizer to one side or the other of the television or radio.
- c) Move the synthesizer farther away from the television or radio.
- d) Plug the synthesizer into a different AC circuit than the television or radio.
- e) Consider installing a rooftop television antenna with coaxial cable lead-in between the antenna and the television.

If necessary, you should consult your dealer or an experienced radio/television technician for additional suggestions. You may find helpful the following booklet prepared by the Federal Communications Commission:

"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.

## CHAPTER 18/CONTROL SWITCH DICTIONARY

### CONTROL SWITCH DICTIONARY

This is an alphabetical listing of the control panel switch functions. The icons A-K and 1-12 indicate that any of the letters or numbers within the range can be pressed.

Multiple switch commands can be aborted before pressing the last switch in the sequence. If the command started out with UPPER FUNCTION, it can always be aborted by pressing UPPER FUNCTION again. If the command started out with LOWER FUNCTION, it can always be aborted by pressing LOWER FUNCTION again. The abort mechanisms for other commands are specified in the individual command descriptions.

When the same switch is used to either turn a function on or to turn it off it is referred to as "toggling." If a function is off and you want it on, pressing the switch controlling that function will "toggle" in on, and vice versa.

For more detailed information concerning any of the descriptions below, refer to the appropriate chapter.

-----  
1-12 - The program residing at that number is called up. The Polaris infers you desire the currently selected program bank (A-K).

A-K - Selects a program bank, and will reveal any programs residing in that program bank. Existing programs will appear as lit LEDs in the number switches (1-12). The program bank letter switch will flash until you complete or abort your choice.

A-K, 1-12 - Specifies first the bank and then the program within that bank. To abort the selection process after pressing one of the letter switches, press the same (flashing) letter switch again.

BEND LEVER RANGE - Allows you to adjust the amount of pitch bend the Bend Lever (the rightmost lever next to the keyboard) imparts to the two oscillators using the slider in the ASSIGNABLE CONTROL section, and optionally engages the Selective Pitch Bend feature.

CUTOFF PEDAL - Allows you to adjust the degree to which the pedal affects the filter cutoff using the slider in the ASSIGNABLE CONTROL section. DETUNE - Allows you to tune Oscillator 2 up to a semitone sharp in either normal or skewed tuning using the slider in the ASSIGNABLE CONTROL section.

ENV PWM - Selects the envelope modulation to be applied to the pulse width.

FIXED - Makes the volume envelope the same for all keystrokes.

GLIDE - Allows you to adjust the time it takes the oscillator to slide from note to note using the slider in the ASSIGNABLE CONTROL section.

KYBD RANGE - Transposes the keyboard up one octave.

LINK LOWER - The link sound is heard below the keyboard split point and the main sound is heard above the keyboard split point.

LINK LOWER, LINK LOWER - A Link Lower is set up between the main program and the current link program, or to the last program linked to.

LINK UNISON - The link sound is heard in unison with the main sound. There is no keyboard split point.

LINK UNISON, LINK UNISON - A Link Unison is set up between the main program and the current link program, or to the last program linked to.

LINK UPPER - The link sound is heard above the keyboard split point and the main sound is heard below the keyboard split point.

LINK UPPER, LINK UPPER - A Link Upper is set up between the main program and the current link program, or to the last program linked to.

LOWER FUNCTION - Pressing this switch accesses the functions with labels beneath the switch.

LOWER FUNCTION, 11 - All sound ceases, and the main (and link, if applicable) sounds are set up again. Local control is restored. This is useful if the MIDI or Chroma Interface fouls up and leaves some notes stuck on. This is also referred to as a "warm reset."

LOWER FUNCTION, ADJUSTMENTS, 1 - The Master slider adjusts the Stop mode click volume.

LOWER FUNCTION, ADJUSTMENTS, 2 - The Master slider adjusts the Record mode click volume.

LOWER FUNCTION, ADJUSTMENTS, 3 - The Master slider adjusts the Play mode click volume.

LOWER FUNCTION, ADJUSTMENTS, 4 - The Master slider adjusts the switch press click volume.

LOWER FUNCTION, ADJUSTMENTS, 5 - The Master slider adjusts the error honk click volume. Pressing this repeatedly allows you to hear the honk volume.

LOWER FUNCTION, ADJUSTMENTS, 7 - The lever ranges are measured.

LOWER FUNCTION, ADJUSTMENTS, 8 - The pedal range is measured.

LOWER FUNCTION, ADJUSTMENTS, 9 - The Master slider adjusts the volume offset of the most recently played channel. Pressing 9 again resets them all to mid-scale.

LOWER FUNCTION, ADJUSTMENTS, 10 - The Master slider adjusts the sensitivity of the most recently played key. Pressing 10 again resets them all to mid-scale.

LOWER FUNCTION, BACK 1 BEAT -- Causes the sequence currently playing to skip backwards one beat. This could be used to get back into step with a drummer who has dropped a beat.

LOWER FUNCTION, CASSETTE, 1 - The cassette load monitor is toggled.

LOWER FUNCTION, CASSETTE, 2 - The cassette save monitor is toggled.

LOWER FUNCTION, CASSETTE, 3 - The cassette input level is toggled. Off is audio, on is digital.

LOWER FUNCTION, CASSETTE, 4 - The cassette output level is toggled. Off is low, on is high.

LOWER FUNCTION, CASSETTE, 7 - The Chroma Panel Switch is toggled.

LOWER FUNCTION, CASSETTE, 8 - The MIDI Panel Switch is toggled.

LOWER FUNCTION, CASSETTE, 9 - The MIDI Omni Mode is toggled.

LOWER FUNCTION, CASSETTE, 10 - The MIDI Mono Mode is toggled.

LOWER FUNCTION, CASSETTE, 11 - The Main Workspace program is sent out over the Chroma Interface.

LOWER FUNCTION, CASSETTE, 12 - The Main workspace program is sent out over the MIDI Interface.

LOWER FUNCTION, CHANNEL CK, 1 - Channel 1 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 2 - Channel 2 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 3 - Channel 3 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 4 - Channel 4 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 5 - Channel 5 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 6 - Channel 6 is enabled/disabled

LOWER FUNCTION, CHANNEL CK, 7 - The most recently played channel is enabled/disabled.

LOWER FUNCTION, DIAGNOSTICS, 1 - The charge on the battery is displayed in the right column of LEDs in the Assignable Control section. Two or more LEDs is acceptable.

LOWER FUNCTION, DIAGNOSTICS, 2 - The software revision level is displayed by a flashing number LED.

LOWER FUNCTION, DIAGNOSTICS, 3 - All LEDs are turned on.

LOWER FUNCTION, DIAGNOSTICS, 4 - The LED above the Master slider turns on when the Master slider produces a value of 255.

LOWER FUNCTION, DIAGNOSTICS, 12, STOP - The entire memory is erased, and the Polaris is reset.

NOTE: This really, honestly does erase everything in the Polaris' memory. Everything. All adjustments, including the factory adjustments, will need to be performed after this.

LOWER FUNCTION, EDIT LINK - The letter switch LEDs and number switch LEDs show the number of the program linked to, and the programming switches and sliders are connected to the link sound.

LOWER FUNCTION, FWD 1 BEAT - This causes the sequence currently playing to skip forward one beat. This could be used to get back into step with a drummer who has added an extra beat.

LOWER FUNCTION, INTERFACE, 1 - The Main Local Control Switch is toggled.

LOWER FUNCTION, INTERFACE, 2 - The Link Local Control Switch is toggled.

LOWER FUNCTION, INTERFACE, 3 - The Sequencer Local Control Switch is toggled.

LOWER FUNCTION, INTERFACE, 4 - The Main Chroma Out Switch is toggled.

LOWER FUNCTION, INTERFACE, 5 - The Link Chroma Out Switch is toggled.

LOWER FUNCTION, INTERFACE, 6 - The Sequencer Chroma Out Switch is toggled.

LOWER FUNCTION, INTERFACE, 7 - The Main MIDI In Switch is toggled.

LOWER FUNCTION, INTERFACE, 8 - The Link MIDI In Switch is toggled.

LOWER FUNCTION, INTERFACE, 9 - The Sequencer MIDI In Switch is toggled.

LOWER FUNCTION, INTERFACE, 10 - The Main MIDI Out Switch is toggled.

LOWER FUNCTION, INTERFACE, 11 - The Link MIDI Out Switch is toggled.

LOWER FUNCTION, INTERFACE, 12 - The Sequencer MIDI Out Switch is toggled.

LOWER FUNCTION, KYBD SPLIT, (keyboard input) - The specified key becomes the first key of the upper part of the keyboard.

LOWER FUNCTION, METRONOME, 1 - The internal metronome operates normally.

LOWER FUNCTION, METRONOME, 2 - The metronome is the master, the Sync Interface output produces sync pulses.

LOWER FUNCTION, METRONOME, 3 - The metronome is the master, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 4 - The metronome is the master, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 5 - The metronome is slaved to the Sync Interface input.

LOWER FUNCTION, METRONOME, 6 - The metronome is slaved to the Sync Interface input, the Sync Interface output produces sync pulses.

LOWER FUNCTION, METRONOME, 7 - The metronome is slaved to the Sync Interface input, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 8 - The metronome is slaved to the Sync Interface input, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 9 - The metronome is slaved to the timing bytes from the MIDI Interface input.

LOWER FUNCTION, METRONOME, 10 - The metronome is slaved to the MIDI Interface input, the Sync Interface output produces sync pulses.

LOWER FUNCTION, METRONOME, 11 - The metronome is slaved to the MIDI Interface input, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, METRONOME, 12 - The metronome is slaved to the MIDI Interface input, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.

LOWER FUNCTION, MIDI CHANNEL, 1 - 6 - The MIDI Basic Channel (b) is set to the sum of these.

LOWER FUNCTION, MIDI CHANNEL, 7 - The MIDI Interface input has no extra channels.

LOWER FUNCTION, MIDI CHANNEL, 8 - The MIDI Interface input uses extra channel b+3.

LOWER FUNCTION, MIDI CHANNEL, 9 - The MIDI Interface input use extra channels b+3 and b+4.

LOWER FUNCTION, MIDI CHANNEL, 10 - The MIDI Interface input uses extra channels b+3, b+4 and b+5.

LOWER FUNCTION, MIDI CHANNEL, 11 - The MIDI Interface input uses extra channels b+3 through b+6.

LOWER FUNCTION, MIDI CHANNEL, 12 - The MIDI Interface input uses extra channels b+3 through b+7.

LOWER FUNCTION, NO LINK - The link is turned off.

LOWER FUNCTION, RESET - The instrument resets itself as if it had just been turned on. This is also referred to as a "cold reset."

LOWER FUNCTION, SLIDER TEMPO - Allows you to manually set the tempo of the Polaris metronome with the slider in the MASTER section.

LOWER FUNCTION, STORE LINK, A-K, 1-12 - The link sound is stored in memory, and the specified program number becomes the new link program number.

LOWER FUNCTION, STORE LINK, STORE LINK - The link sound is stored back into memory where it came from.

LOWER FUNCTION, SYNC INPUT, 1 - Sets the Sync Interface input clock ratio at 12 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 2 - Sets the Sync Interface input clock ratio at 24 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 3 - Sets the Sync Interface input clock ratio at 48 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 4 - Sets the Sync Interface input clock ratio at 96 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 5 - Sets the Sync Interface input clock ratio at 192 clocks per beat.

LOWER FUNCTION, SYNC INPUT, 6 - Toggles the polarity of the Sync Interface input trigger.

LOWER FUNCTION, SYNC INPUT, 12 - Toggles the Sync Interface input level.

LOWER FUNCTION, SYNC OUTPUT, 1 - Sets the Sync Interface output ratio at 12 clocks per beat.

LOWER FUNCTION, SYNC OUTPUT, 2 - Sets the Sync Interface output ratio at 24 clocks per beat.

LOWER FUNCTION, SYNC OUTPUT, 3 - Sets the Sync Interface output ratio at 48 clocks per beat.

LOWER FUNCTION, SYNC OUTPUT, 4 - Sets the Sync Interface output ratio at 96 clocks per beat.

LOWER FUNCTION, SYNC OUTPUT, 5 - Sets the Sync Interface output ratio at 192 clocks per beat.

LOWER FUNCTION, SYNC OUTPUT, 6 - Toggles the polarity of the Sync Interface output square wave.

LOWER FUNCTION, SYNC OUTPUT, 7 - Sets the Sync Interface output rate limit to 1200Hz.

LOWER FUNCTION, SYNC OUTPUT, 8 - Sets the Sync Interface output rate limit to 600Hz.

LOWER FUNCTION, SYNC OUTPUT, 9 - Sets the Sync Interface output rate limit to 400Hz.

LOWER FUNCTION, SYNC OUTPUT, 10 - Sets the Sync Interface output rate limit to 300Hz.

LOWER FUNCTION, SYNC OUTPUT, 11 - Sets the Sync Interface output rate limit to 200Hz.

LOWER FUNCTION, SYNC OUTPUT, 12 - Sets the Sync Interface output rate limit to 150Hz.

LOWER FUNCTION, TUNE ALL - Tunes all of the voices in the Polaris. The entire procedure takes only a few seconds.

MOD LEVER RANGE - Allows you to adjust the amount of vibrato or trill the Mod Lever (the leftmost lever on the keyboard) will apply to the two oscillators using the slider in the ASSIGNABLE CONTROL section.

NOISE - Feeds pink noise into the oscillators.

OSC 1 VIBRATO - Allows you to adjust how much delayed vibrato is applied to Oscillator 1 using the slider in the ASSIGNABLE CONTROL section.

OSC 2 ENV - Allows you to adjust how much the main envelope modulates the pitch of Oscillator 2 using the slider in the ASSIGNABLE CONTROL section.

OSC 2 VIBRATO - Allows you to adjust how much delayed vibrato is applied to Oscillator 2 using the slider in the ASSIGNABLE CONTROL section.

PITCH PEDAL - Allows you to adjust the amount of pitch bend the pedal imparts to the two oscillators using the slider in the ASSIGNABLE CONTROL section.

PLAY - Play mode is entered if the sequencer is stopped. If already in Play mode, the metronome is toggled. If the sequencer is recording, it is stopped, and the track just recorded is chained to itself.

PULSE - Selects a waveform with odd harmonics only.

RATE PEDAL - Allows you to adjust the degree to which the pedal affects the sweep rate using the slider in the ASSIGNABLE CONTROL section.

RECORD - Record mode is entered. Only works when the sequencer is stopped.

RING MOD - Replaces the normal sound of the oscillators with the digital cross-product of the oscillator's pulse outputs.

SAWS - Selects a waveform with both even and odd harmonics.

SINE - Selects a sine wave as the shape of the sweep signal.

SQUARE - Selects a square wave as the shape of the sweep signal.

STOP - If the sequencer is playing or recording, it is stopped and the metronome is stopped. If the sequencer is stopped, the metronome is toggled.

SWP PWM - Selects sweep modulation to be applied to the pulse width.

SYNC - Synchronizes Oscillator 2 to Oscillator 1.

TOUCH - Makes the Polaris keyboard touch sensitive.

TRANSPOSE - Readies the Polaris to tune the oscillator to the next key pressed on the keyboard.

TUNE - Allows you to manually tune the Polaris using the slider in the MASTER section.

UPPER FUNCTION - Pressing this switch accesses the functions with labels above the switches.

UPPER FUNCTION, CASS RUN/STOP - The cassette motor control is toggled.

UPPER FUNCTION, CHAIN SEQ, 1-12 - The currently selected sequence is chained to the specified sequence, and that sequence becomes the currently selected sequence.

UPPER FUNCTION, ERASE PROG, A-K, 1-12 - The specified number is erased.

UPPER FUNCTION, ERASE SEQ, 1-12 - The specified sequence is erased. This only works when the sequencer is stopped.

UPPER FUNCTION, LOAD ALL - Everything on the tape is loaded.

UPPER FUNCTION, LOAD PROG - The tape runs until a single program has been loaded into the main workspace. Everything else on the tape is ignored.

UPPER FUNCTION, LOAD SEQ - The tape runs until a single sequence has been loaded over the current sequence. Everything else on the tape is ignored.

UPPER FUNCTION, MEMORY USED - The approximate percentage of memory used is displayed in the right half of the ASSIGNABLE CONTROL section until the operation is aborted by pressing LOWER FUNCTION.

UPPER FUNCTION, SAVE ALL PROG - All programs are saved on tape.

UPPER FUNCTION, SAVE ALL SEQS - All sequences are saved on tape.

UPPER FUNCTION, SAVE PROG - The main workspace program is saved on tape.

UPPER FUNCTION, SAVE SEQ - The current sequence is saved on tape.

UPPER FUNCTION, SELECT SEQ, 1-12 - The specified sequence is selected.

UPPER FUNCTION, SEQ CUE - If the currently selected sequence has no cue flag at the end, it is given one. If it has one, it is removed.

UPPER FUNCTION, SEQ PROG, A-K, 1-12 - The specified program becomes the initial program for the currently selected sequence.

UPPER FUNCTION, SEQ TEMPO - If the metronome is stopped, the tempo in the currently selected sequence is erased. If the metronome is running, the tempo in the currently selected sequence is set to the metronome tempo.

UPPER FUNCTION, STORE PROG, A-K, 1-12 - The current program is stored. The specified program number becomes the current program number.

UPPER FUNCTION, SWAP PROG, A-K, 1-12 - The current program is swapped with the specified stored program.

UPPER FUNCTION, SWAP SEQ, 1-12 - The currently selected sequence is swapped with the specified sequence. This only works when the sequencer is stopped.

UPPER FUNCTION, TUNE ONE - Tells the Polaris to tune only the last used channel.

UPPER FUNCTION, VERIFY - The tape runs until an error is detected.

UPPER FUNCTION, WHICH SEQ? - The number of the currently selected sequence flashes a few times.

VIBRATO DELAY - Allows you to adjust the amount of delay between the keystroke and the onset of vibrato or trill using the slider in the ASSIGNABLE CONTROL section.

VIBRATO PEDAL - Allows you to adjust the amount of vibrato or trill the pedal will apply to the two oscillators using the slider in the ASSIGNABLE CONTROL section.

VOLUME (in the ASSIGNABLE CONTROL section) - Used to balance linked sounds to the main sound. Also used to balance the play-along sound to the sequencer sound.

VOLUME (in the MASTER section) - Used to adjust the overall volume of the instrument.

VOLUME PEDAL - Allows you to adjust the degree to which the pedal affects the volume using the slider in the ASSIGNABLE CONTROL section.

## QUICK REFERENCE

- LF, 11 - Warm reset.
- LF, 12 - Cold reset.
- LF, A, 1 - Stop mode click volume.
- LF, A, 2 - Record mode click volume.
- LF, A, 3 - Play mode click volume.
- LF, A, 4 - Switch press click volume.
- LF, A, 5 - Error honk volume.
- LF, B, 1 - The Main Local Control Switch.
- LF, B, 2 - The Link Local Control Switch.
- LF, B, 3 - The Sequencer Local Control Switch.
- LF, B, 4 - The Main Chroma Out Switch.
- LF, B, 5 - The Link Chroma Out Switch.
- LF, B, 6 - The Sequencer Chroma Out Switch.
- LF, B, 7 - The Main MIDI In Switch.
- LF, B, 8 - The Link MIDI In Switch.
- LF, B, 9 - The Sequencer MIDI In Switch.
- LF, B, 10 - The Main MIDI Out Switch.
- LF, B, 11 - The Link MIDI Out Switch.
- LF, B, 12 - The Sequencer MIDI Out Switch.
- LF, C, 1 - The cassette load monitor.
- LF, C, 2 - The cassette save monitor.
- LF, C, 3 - Cassette input level. Off is audio, on is digital.
- LF, C, 4 - Cassette output level. Off is low, on is high.
- LF, C, 7 - The Chroma Panel Switch.
- LF, C, 8 - The MIDI Panel Switch.
- LF, C, 9 - The MIDI Omni Mode.
- LF, C, 10 - The MIDI Mono Mode.
- LF, C, 11 - The Main Workspace program is sent out over the Chroma Interface.
- LF, C, 12 - The Main workspace program is sent out over the MIDI Interface.
- LF, D, 12, STOP - The entire memory is erased, and the Polaris is reset.
- LF, E, 1 - Channel 1 is enabled/disabled
- LF, E, 2 - Channel 2 is enabled/disabled
- LF, E, 3 - Channel 3 is enabled/disabled
- LF, E, 4 - Channel 4 is enabled/disabled
- LF, E, 5 - Channel 5 is enabled/disabled
- LF, E, 6 - Channel 6 is enabled/disabled
- LF, E, 7 - The most recently played channel is enabled/disabled.
- LF, H, 1 - The internal metronome operates normally.
- LF, H, 2 - The metronome is the master, the Sync Interface output produces sync pulses.
- LF, H, 3 - The metronome is the master, the MIDI Interface output produces timing bytes.
- LF, H, 4 - The metronome is the master, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.
- LF, H, 5 - The metronome is slaved to the Sync Interface input.
- LF, H, 6 - The metronome is slaved to the Sync Interface input, the Sync Interface output produces sync pulses.
- LF, H, 7 - The metronome is slaved to the Sync Interface input, the MIDI Interface output produces timing bytes.

LF, H, 8 - The metronome is slaved to the Sync Interface input, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.  
 LF, H, 9 - The metronome is slaved to the timing bytes from the MIDI Interface input.  
 LF, H, 10 - The metronome is slaved to the MIDI Interface input, the Sync Interface output produces sync pulses.  
 LF, H, 11 - The metronome is slaved to the MIDI Interface input, the MIDI Interface output produces timing bytes.  
 LF, H, 12 - The metronome is slaved to the MIDI Interface input, the Sync Interface output produces sync pulses, the MIDI Interface output produces timing bytes.  
 LF, I, 1 - Sets the Sync Interface input clock ratio at 12 clocks per beat.  
 LF, I, 2 - Sets the Sync Interface input clock ratio at 24 clocks per beat.  
 LF, I, 3 - Sets the Sync Interface input clock ratio at 48 clocks per beat.  
 LF, I, 4 - Sets the Sync Interface input clock ratio at 96 clocks per beat.  
 LF, I, 5 - Sets the Sync Interface input clock ratio at 192 clocks per beat.  
 LF, I, 6 - Toggles the polarity of the Sync Interface input trigger.  
 LF, I, 12 - Toggles the Sync Interface input level.  
 LF, J, 1 - Sets the Sync Interface output ratio at 12 clocks per beat.  
 LF, J, 2 - Sets the Sync Interface output ratio at 24 clocks per beat.  
 LF, J, 3 - Sets the Sync Interface output ratio at 48 clocks per beat.  
 LF, J, 4 - Sets the Sync Interface output ratio at 96 clocks per beat.  
 LF, J, 5 - Sets the Sync Interface output ratio at 192 clocks per beat.  
 LF, J, 6 - Toggles the polarity of the Sync Interface output square wave.  
 LF, J, 7 - Sets the Sync Interface output rate limit to 1200Hz.  
 LF, J, 8 - Sets the Sync Interface output rate limit to 600Hz.  
 LF, J, 9 - Sets the Sync Interface output rate limit to 400Hz.  
 LF, J, 10 - Sets the Sync Interface output rate limit to 300Hz.  
 LF, J, 11 - Sets the Sync Interface output rate limit to 200Hz.  
 LF, J, 12 - Sets the Sync Interface output rate limit to 150Hz.  
 LF, K, 1 - 6 - The MIDI Basic Channel (b) is set to the sum of these.  
 LF, K, 7 - The MIDI Interface input has no extra channels.  
 LF, K, 8 - The MIDI Interface input uses extra channel b+3.  
 LF, K, 9 - The MIDI Interface input use extra channels b+3 and b+4.  
 LF, K, 10 - The MIDI Interface input uses extra channels b+3, b+4 and b+5.  
 LF, K, 11 - The MIDI Interface input uses extra channels b+3 through b+6.  
 LF, K, 12 - The MIDI Interface input uses extra channels b+3 through b+7

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