

# Realtime Controls

After completing this lesson, the student should be familiar with the following concepts:

- Footswitches, expression pedals, and pedalboard are three controllers which may be operated with a performer's feet.
- Many synthesizer keyboards can sense how hard a key is struck, how much pressure is applied while it is held, and how quickly the key is released.
- Pitch bend wheels, modulation wheels and their counterparts, and joystick and paddle are common controllers on keyboard synths. They allow players to control patches to make them more expressive.
- Ribbon controllers, breath controllers, and X-Y pads are some more uncommon controllers which can be used to provide additional control over a sound.
- Alternate controllers allow people without keyboard skills to play synthesizers.

## Glossary for this Lesson:

**Aftertouch-** Aftertouch is pressure applied to keys which have already been played. Some keyboards are capable of sensing this pressure and reacting to it. Pressure is often set up to change volume, brightness, or vibrato depth, but like most other controllers, aftertouch can impact any parameter you wish on most synths.

**Alternate Controller -** An alternate controller is a device other than a keyboard which allows a user to play a synthesizer. Many alternate controllers simulate other acoustic instruments such as wind, string, or percussion instruments to make the world of synthesizers available to people who are skillful at playing those instruments.

**Breath Controller -** A breath controller is a small device into which one blows. As the air pressure in the controller increases, the controller generates different values and sends them to a synthesizer. The synthesizer can do many different things with this data, including changing volume, brightness, or timbre. Breath controllers are seldom seen or used today.

**Expression Pedal-** An expression pedal is a foot pedal which allows one to rock one's foot forward and backward to create different values. Expression pedals can be found on most organs. Generally, expression pedals are used to change volume, but they can impact almost any parameter on a synth.

**Footswitch-** A footswitch is a small device which can generate on and off signals. Footswitches are commonly used to simulate the damper pedals found on a piano. However, any function which needs to be turned on and off is a prime candidate for control by a footswitch. Portamento on/off is another common use for a footswitch.

**Modulation Wheel-** A modulation wheel is a thin disc whose side protrudes from the top of a keyboard. By rolling the disc away from the player, the modulation depth is increased, and by rolling the disc towards the player, the depth is decreased. Modulation wheels are used to control many different parameters on synthesizers, but common uses include vibrato depth (by far the most common application), brightness, and fading between two different sounds. Like other controllers, mod wheels can be used to control just about any parameter on a modern synth.

**Paddle-** A paddle is an all-in-one alternative to a pitch bend wheel and modulation wheel. By pushing the paddle's lever right or left, pitch can be increased or decreased in a manner similar to a pitch bend wheel. By pushing the paddle forward, modulation depth is increased. Most paddles are spring-loaded in both directions, meaning that it is impossible for a novice user to leave the wheel in the wrong place. Some would argue that it takes away from the flexibility of the mod wheel's control. Spring-loaded joysticks are another manifestation of paddles.

**Pedalboard-** A pedalboard simulates the pedals found beneath organs. A pedal board allows you to play notes with your feet by playing large keys arranged in a manner which is similar to a piano keyboard.

**Pitch Bend Wheel-** A spring-loaded wheel which allows players to increase or decrease pitch. The amount of increase or decrease can be set in half steps.

**Ribbon Controller-** A ribbon controller is a long, touch-sensitive controller which creates data based on the location of the user's finger on the ribbon. Ribbon controllers can impact a variety of different parameters, but filter cutoff (brightness) and sound-morphing are two favorites of synthesizer programmers.

**Stick-** See paddle.

**Release Velocity-** Release velocity is the speed at which a key is released. Very few keyboards ever made could create release velocity data, but most modern synthesizers can respond to it. Release velocity can be used to control a variety of different things, but it is frequently used to control the length of time sounds take to decay. This can result in timbral changes under certain circumstances owing to the nature of digital filters used in many modern synthesizers.

**Velocity-** Velocity is the force with which each key is struck. While not all keyboards are capable of sensing velocity, most pro-level synth keyboards can. Velocity is frequently used to control not only loudness, but also brightness, and envelope time. Velocity is sensed per key, with each note played transmitting its own velocity level.

**X-Y Pad-** A small touch sensitive space which generates two sets of data. The first is generated based on the horizontal location of the user's finger while the second is based on the vertical location of the user's finger. X-Y pads are very helpful when one wants to control two parameters separately, but with one finger. X-Y pads are fairly rare, and as such there are few standards for controller assignment.

### HELP YOUR STUDENT REVIEW

There is a lot of information in this book (really, there is!) and after a while, your student may discover that he or she doesn't remember the difference between a chorus unit and a compressor, a reverberator and a return, an insert and microphone impedance (we didn't actually cover that.) The point is that an occasional review through past lessons is a great idea. The quizzes for this book frequently use questions from old quizzes, so reviewing old quizzes each week is one excellent way to keep all of the information fresh in your student's mind.

An occasional reread through a lesson or two here and there. This book is designed to continually build on previous concepts, so it is important that students remember each lesson well.

# Realtime Controls

Now that we have learned a little bit about the patches you can find in synthesizers, and how we call them up on different instruments, it is time to talk about some of the devices used to control these sounds as we play them. You might have noticed the title of this lesson “real-time controls.” The controls we are going to learn about in this lesson are called real-time controls because they allow you to change patches as you play *in real time*.

## IT’S TIME TO PUT YOUR FOOT DOWN

Because there are so many different things that we can change and control on a synthesizer, we often end up using our feet to control patches as well as using our hands. There are three basic devices which allow us to control patches using our feet.

**Footswitches** come in all shapes and sizes, from a little plastic block to what looks like a damper pedal ripped from a Steinway grand piano, but they all do the same thing: they tell a synthesizer if your foot is up or down. What the synthesizer does with this information depends upon how the sound was created. A footswitch can do one of hundreds of things, but most of the time, footswitches are programmed to act like hold pedals. As long as you hold the pedal down, the synthesizer will continue to make all of the notes you play hold, even if you take your hands off the keys. Most keyboards have at least one pedal jack (some have as many as 4 or 5) but if there is only one, it usually acts like a hold pedal. Most tone modules do not have footswitch jacks, but there are a few that do. You can see a footswitch near the top of this page.

**Expression pedals** are found on most organs, but synthesizer players like to use them as well. On an expression pedal, you can rock your foot

forward or back to create changes in the sound. Just like all of the controls we will learn about in this lesson, the expression pedal can do many different things depending upon how the synthesizer’s patch was created. Most of the time, the expression pedal either acts like a volume knob or makes the sound brighter or darker depending upon how you move it. An expression pedal plugs into

a jack that looks just like a footswitch jack. Not all keyboard synthesizers have expression pedal jacks, but many more expensive ones do. Some keyboards (notably mother keyboards) sometimes allow you to connect as many as 4 expression pedals at once, each of which can do something different! You can see a picture of an expression pedal near the bottom of this page.

**Pedalboards** simulate the pedals found underneath organs. A pedal board is like a keyboard for your feet. It allows you to play notes just like you would with your hands. Many modern pedalboards also have some switches on the top of them which can do different things. Pedalboards generally can’t make any sound on their own, but can play another synthesizer when connected to that instrument’s MIDI jack.

## USING YOUR HANDS

Now that we have covered what you can do with your feet, it is time to talk about what you can do with your hands. There are many controllers that are intended for hands, but none of them is more obvious and more common than a keyboard. Playing keyboards is pretty easy to understand, but there are a few fine points which are unique to syn-



thesizers which are very different from pianos. Like a piano, synthesizer keyboards can sense how hard you play the keys. This is called **velocity** sensing. A few highly specialized keyboards can not only sense how hard you play the keys, but also how quickly you let the keys up. This is called **release velocity**. Although almost every modern synthesizer can respond to incoming release velocity messages, no keyboard currently being produced can make release velocity messages.

Unlike pianos, changing your playing velocity doesn't always change volume. Like all of the other controllers we have learned about so far, it all depends on how the patch was created. While velocity usually changes volume, it also can cause the synthesizer to switch from one kind of sound to another. (The patch doesn't actually change on the screen; a different part of the patch is just brought out.) For instance, a piano sound might change to a brass section when you play harder.

## A TOUCHY CONTROLLER

**Aftertouch** is a common feature on modern synthesizer keyboards. Aftertouch allows you to press into a synthesizer's keys after you have played them. Aftertouch can do different things, but it usually adds vibrato (a wavy quality to the sound that makes the sound more human). Some keyboards have very stiff aftertouch which takes a lot of strength to activate. It is easy to strain your wrists by using aftertouch too much, so it is important not to use aftertouch too much when you first start out. You can almost always use a different controller instead of aftertouch and accomplish the same thing without the wrist strain, so this is usually a better way to go.

## PADDLES AND WHEELS

Two controls that are found on almost every synthesizer keyboard ever made are pitch bend and modulation wheel controls. A **pitch bend wheel** is a spring-loaded wheel that always snaps back to its



center position. When you pull the wheel towards you, the note the synthesizer is playing glides lower. Likewise, pushing the wheel away from you causes the synthesizer to raise its pitch. This allows you to simulate the way in which many acoustic instruments are able to glide smoothly from pitch to pitch. Pitch bend is also appropriate when used with electric guitar sounds. On most synthesizers,

you can set how much the pitch bend wheel effects the pitch of the patch in half-steps. You can see an example of pitch bend and modulation wheels near the top of this page. Pitch bend wheels are always found on the left side of a keyboard, and are intended to be used with your left hand. Some manufacturers place wheels to the left of the keyboard (which is usually preferred by keyboard players) while others place the wheels above the keyboard.

It is really important to understand that while a little pitch bend now and then can add a touch of realism to an instrument, constantly bending pitch up and down is not only ineffective musically, it is also really obnoxious. :-) Pitch bend wheels almost always bend pitch, but like all of the other controllers, they can be programmed to do other things. It all depends on how the patch was set up.

**Modulation wheels** are usually located just to the right of pitch bend wheels. Unlike the pitch bend wheel, a mod wheel isn't spring loaded, which means that it stays wherever you put it. Modulation wheels have no effect on the patch when they are pulled all the way towards you. However, most of them have a little dent in them to show you where they are set. Since the pitch wheel has a matching dent and it always snaps back to the middle, people often think that this is where the mod wheel should be set. They are unpleasantly surprised to hear lots of strange, wavy sounds coming from the synthesizer and can't understand why the instrument sounds like this.

Modulation wheels can do just about anything





to a sound you can imagine, but most of the time, they are set up to add vibrato to a patch.

A few manufacturers (most notably Roland and Korg) have used pitch/modulation **paddles** or **sticks** on their synthesizers. (See the bottom of page 60.) A pitch/mod stick is a single controller which acts like a pitch wheel when moved side to side and a mod wheel when pushed forwards. These controllers are spring-loaded in both directions, which keeps people from making the silly mistake of leaving the mod wheel halfway up.

### TIED WITH A RIBBON

Ribbon controllers are an idea that Bob Moog pioneered in the 60's. Although several performers made great use of them on stage, they were expensive to manufacture and prone to frequent problems. Today, only a few synthesizers offer ribbon controllers. **Ribbon controllers** are very useful, however. They can sense even slight pressure and can do just about anything you can imagine to a sound. Korg, Kurzweil, and Roland have all recently produced instruments with ribbon controllers. Kurzweil even makes a ribbon controller that you can add to any keyboard (see the picture at the bottom of this page).



### XYZ

Like ribbon controllers, **X-Y pads** have been around for a while. They have only regained popularity in recent times. An X-Y pad is a small square or rectangle that can sense where you touch it. This is like a ribbon controller, but X-Y pads typically change two different things about the sound. How far right or left your finger is changes one thing while how far

forward or back changes another thing about the sound. Korg makes an X-Y pad which can be added to any synthesizer. You can see it below.



### DO I HAVE BAD BREATH?

The **breath controller** is a very unusual controller. It allows you to change the patch based on how hard you blow into it. Yamaha is the only company which has ever made them, and they are also the only company which has made keyboards with breath controller jacks. Most modern synthesizers are capable of responding to breath controller messages, however.

For all of their cool potential in playing wind instruments like flute or trumpet patches, breath controllers never really caught on very well (maybe keyboard players felt silly using them?) and although they are still available from Yamaha, they are almost never seen or used.

### ALTERNATE CONTROLLERS

There are many other devices which can be used to play synthesizers other than keyboards. These devices are called **alternate controllers**. Alternate controllers are very important, because they allow people who play other instruments to play synthesizers as well. You can easily find drum sets, marimbas, guitars, basses, trumpets, saxophones, clarinets, violins, cellos, and even accordions which can play synthesizers. One company even makes a special device you wear under your collar that can tell what note you are singing and allow you to play a synthesizer like that! Some alternate controllers are even able to sense where your hands are in the air without ever touching them!



## Let's Review

1. What are the three controls that allow you to use your feet to control sounds?
2. What are some different ways keyboards allow us to control sounds?
3. What are the wheels found on the left side of most keyboards? What is the alternative to these wheels that some synthesizer keyboards use?
4. What are ribbon controllers, breath controllers, and X-Y pads, and what does each do?
5. What are alternate controllers and why are they important?

### Words To know:

Aftertouch	Pedalboard
Alternate Controller	Pitch Bend Wheel
Breath Controller	Ribbon Controller
Expression Pedal	Stick
Footswitch	Release Velocity
Modulation Wheel	Velocity
Paddle	X-Y Pad

### DID YOU KNOW?

The band D'cuckoo is really into alternate controllers. In addition to two percussion controllers they made themselves, the band also tosses a giant beachball into the audience during concerts. The beachball has sensors in its skin which trigger musical sounds in the band's synthesizers.

### Experiments:

1. Try controlling a patch with velocity and aftertouch. (Your teacher will help you to select some appropriate patches.) Be sure to try different levels of each to see what effect they have on the sound.
2. Find a keyboard which has pitch bend and modulation wheels. What does each do? Does the modulation wheel do something different in different patches?
3. Experiment with a musical use of the pitch bend wheel. How is it used most musically?
4. Find a keyboard which has a paddle or stick instead of a pair of wheels.
5. Try out ribbon controllers, breath controllers, and X-Y pads if they are available.