



## Hot Hand MIDI Expression Controller Users Guide

Thank you for purchasing a Hot Hand MIDI- EXP Controller. The MIDI-EXP is a general purpose controller that translates motion of the Hot Hand sensor into generic MIDI messages and a flexible expression output. It can be used with a wide variety of 3<sup>rd</sup>-party effects units, keyboards, software. The MIDI- EXP offers an extensive feature set that allows you achieve the full potential of Hot Hand motion control.

This Users Guide explains the individual controls then moves on to Saving, Calibration, and Trigger mode descriptions. Lastly, it features two step by step examples for using the MIDI- EXP with some 3<sup>rd</sup>-party effects units.

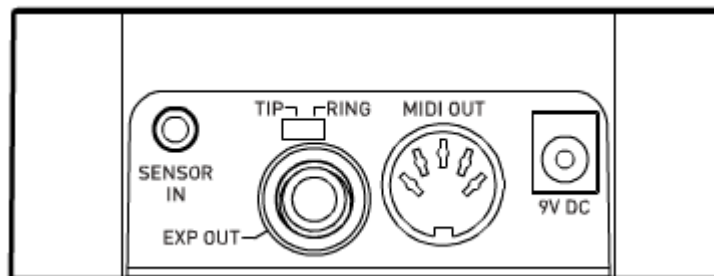
Enjoy!

The Source Audio Team

### Basics:

#### Inputs and Outputs

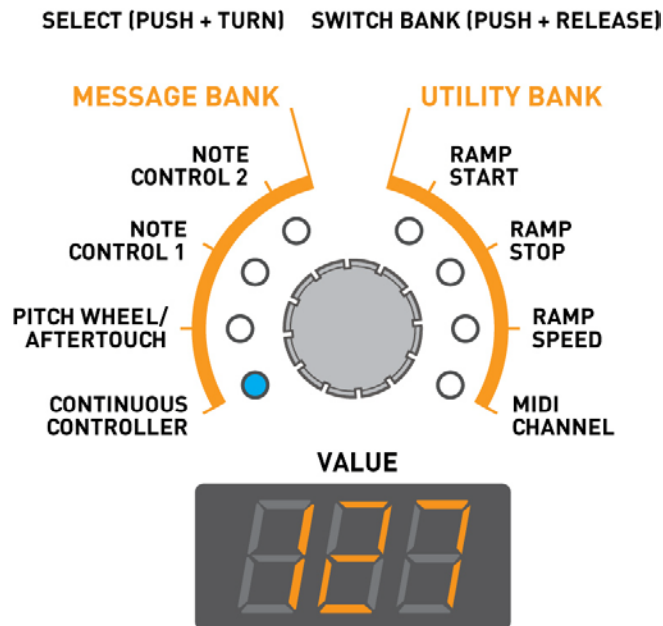
The MIDI-EXP unit has 4 jacks and one switch on the back panel, they are from left to right: the sensor input, expression pedal tip/ring switch, expression pedal out, MIDI OUT, 9V DC input.



- The sensor input is identical to sensor inputs on any other Hot Hand products, the jack provides power to the sensor and receives X and Y axis signals from the ring. Either a wired or wireless Hot Hand sensor can be used.
- The tip/ring switch determines whether the wiper of the pot is connected to the tip of the plug or the ring. The sleeve connection is hard wired to one end of the pot and does not change. Looking at the unit from the back, if the switch is pushed to the left, the wiper is connected to the tip. If right, the wiper is connect to the ring.
- The expression pedal output is a resistive output in contrast to the expression output on the Hot Hand effects boxes which was really a control voltage output that could be used with most expression pedal inputs. The MIDI-EXP unit uses a digital potentiometer which is basically a chip that has a matrix of internal resistors that can be turned on and off to create a variable resistance which acts almost exactly like a standard passive potentiometer found in an expression pedal. The value of the digital pot is 10k ohms. The three terminals of the potentiometer are wired to the TRS expression output jack.
- The MIDI output jack is a standard MIDI output.
- For the 9V input, please use only the included Source Audio 9V power supply to power the unit.

## Controls

The main control on the front panel is an encoder which selects the current function as well as giving access to parameter values. The value of the currently selected parameter is shown on the 3 digit display. The current function and editable parameter are indicated by the LEDs to the left and right of the encoder. Bank 1 selects the type of MIDI message to be sent and Bank 2 contains utility parameters.



The encoder can be used three different ways: normal turn, push and turn, and push. Here is what each will do:

- Normal turn (without pushing down on the encoder) will allow you to change the value of the parameter indicated by the LEDs and shown on the display. For example, if the LED next to Continuous Controller is lit, turning the encoder will select a value from 0 to 127 that will set the CC number to be sent in the MIDI output.
- Pushing and holding the encoder while turning will select between different functions within the same bank. For example Continuous controller is lit, pushing and turning the encoder will allow you select a different type of MIDI message to sent, pitch wheel, after touch, note messages, etc.
- Pushing the encoder and releasing it without turning will jump between the Message Bank and the Utility Bank.

For each function around the encoder the parameter shown on the display has a different meaning. Here is the list for the Function Bank:

- **Continuous Controller** – in this mode, MIDI CC messages will be sent out. The CC number is shown on the display and can be set from 0 to 127. The controller value is determined by the sensor. There is also a value below 0 which is the OFF setting. In this setting no MIDI messages will be sent for the current axis.
- **Pitch Wheel / Aftertouch** – in this mode, either Pitch Wheel or Channel Aftertouch messages will be sent. The display selects between pitch "PIT" or aftertouch "AFT" message types. The data value is controlled by the sensor. **Note:** If the unit is deactivated or the message type changed, a MIDI message will be sent that resets the Pitch wheel to the midpoint (MIDI value 64).

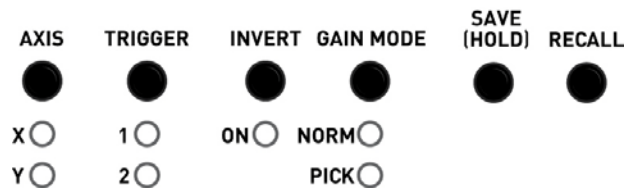
- **Note Control 1** – this mode sends Note On and Note Off MIDI messages. The pitch value of the message is determined by the sensor, the velocity of the Note On command is shown on the display and can be set from 0 to 127. A new message is sent when the pitch value changes. **Note:** If the unit is deactivated in this mode or the message type changed, an “All notes off” MIDI message will be sent on the MIDI output. This applies to both note control modes.
- **Note Control 2** – this mode also sends Note On/Off command but uses the trigger mode (see below) to send on and off commands. The display value is the Note Number to be sent in the MIDI message. Only one note can be sent at a time per axis. More on this mode later.

Here is the list for Utility Bank:

- **Ramp Start** – used for ramp trigger mode, sets the starting point of the ramp. Value goes from 0 to 127.
- **Ramp Stop** – used for ramp trigger mode, sets the stop point for the ramp. Value goes from 0 to 127.
- **Ramp Speed** – used for ramp trigger mode, sets the speed of the ramp from start to stop. Value goes from 0 to 10.
- **MIDI Channel** – sets the MIDI Channel for the current axis, value goes from 1 to 16.

#### Button Functions:

There are six buttons on the front panel. Here are the descriptions for each:



- **Axis** – selects which axis (X or Y) is currently being edited. When the unit is powered up the x axis is displayed. When the axis button is pressed, the display will show the current settings for the y axis. Initially the y axis is set to OFF and will not send any MIDI messages.
- **Trigger** – This button turns on the ramp trigger mode and selects which trigger mode, 1 or 2, will be used. When neither of the trigger LEDs is on, trigger mode is off and the MIDI-EXP unit will send the current value of the sensor data to the MIDI output. This mode is used to trigger ramps in the MIDI output when a given threshold is crossed using Hot Hand. See the ramp trigger mode description for more info.
- **Invert** – the invert button inverts the incoming Hot Hand signal. For example, normally pointing your hand at the ground will produce a “0” on the MIDI output and pointing it towards the ceiling will produce a “127”. When Invert is on the opposite is true.
- **Gain Mode** – selects the gain mode for the sensor input. Normal mode should be used. Pick is designed for our possible future pressure sensitive pick input.
- **Save** – Pressing and holding this button for 2 seconds will put the unit into save mode, this is indicated on the 3 digit display. Press save while in recall mode will cancel the recall operation.
- **Recall** – Pressing the button will put the unit into recall mode. See the saving presets section for details. Pressing recall while in save mode will cancel the save operation.

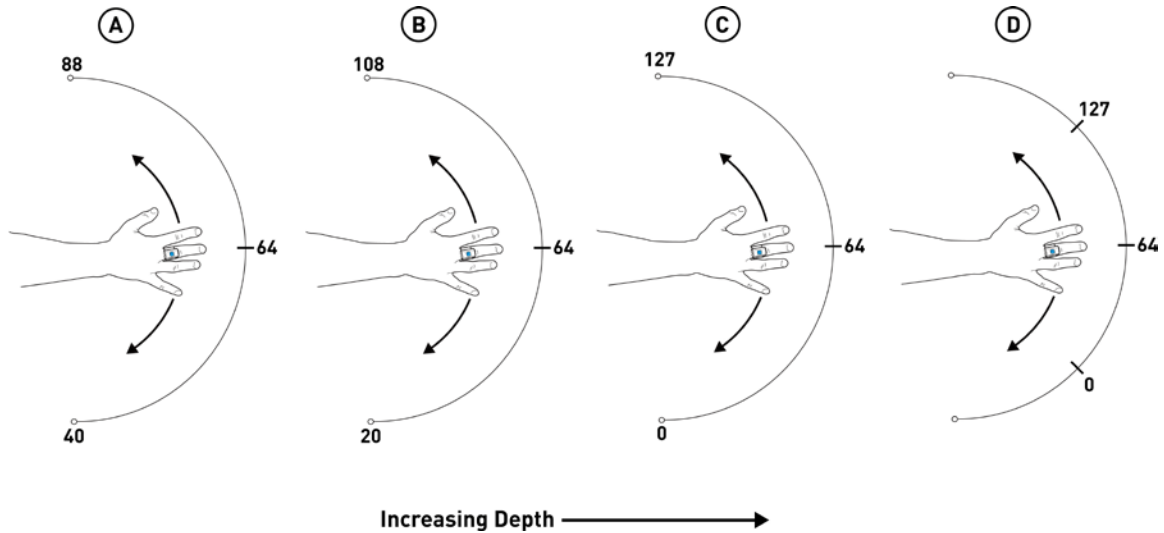
### Footswitch:

The footswitch activates the unit and starts sending MIDI messages and data to the expression output. The current state is indicated by the active LED on the main panel. Pressing the footswitch again will stop all MIDI output and freeze the current expression output value. When the footswitch is pressed, a System Exclusive MIDI message is sent with a value of 0 if the unit is being deactivated or 127 if being activated. This is (or might be) useful for triggering something in software.

### Depth and Smoothing controls:



The depth and smoothing knobs are used to adjust the incoming Hot Hand signals. Increasing the depth will mean that the sensor needs to move less to go through the full 0 to 127 range. For example let's say that using the X axis with a given depth setting, pointing the ring directly at the ground produces an output value of 40 and pointing it directly up produces a value of 88 (A). Holding the sensor flat would result in a value of 64. If the depth is increased, the output value in the down position might be 20 and in the up position 108 (B). It could be increased further so that down is 0 and up is 127 (C). Increasing the depth beyond that will mean that moving the ring only a few degrees up and down from the center position will give the full 0 to 127 range (D). Keep in mind that the center is 64 no matter what the depth is. However, the center can be moved using the calibration feature. See the calibration section for details.



The smoothing knob controls the amount of smoothing or filtering applied to the Hot Hand signal with a low pass filter. Increasing the smoothing will mean that quicker motions will not get through the filter but slower motions will. This means that with the smoothing turned down, very small motions will be picked up and reflected in the MIDI output. By increasing the smoothing you can filter out unwanted fluctuations caused by small movements of the sensor.

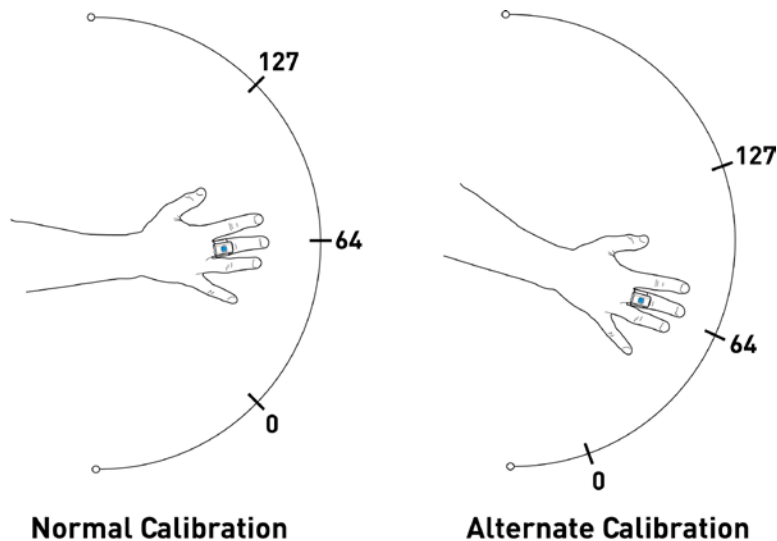
## **Saving:**

When you've dialed in your settings and you want to save a setup to the memory, press and hold the Save button for 2 seconds to put the unit into Save mode. The save mode light on the display will be lit. Use the encoder to select a memory location to save to. There are 8 memory locations available. Once you've picked one, press the save button again and the memory will be written. When the save operation is completed, the display will return to normal. The Save function can be cancelled by pressing the Recall button.

To recall saved settings. Press the recall button and release, this will put the unit into Recall mode, indicated on the display. Select a memory location with the encoder and press recall again to recall the settings. Note that both X and Y axis settings will be saved within one memory location. A Recall function can be cancelled by pressing the Save button.

## **Calibration / Set threshold:**

When the unit is in normal (non-trigger) mode, pressing and holding the footswitch for two seconds will put it into calibrate mode indicated by the Active LED blinking. Once it's in calibrate mode, put your Hot Hand sensor into whatever position you want to be your new midpoint (or value of 64 on the MIDI scale) and press the footswitch again. This will lock in the new midpoint.



When the unit is in one of the trigger modes, pressing and holding the footswitch will instead allow you to set a threshold value for the trigger mode. The calibration value will still apply in trigger mode. See the Trigger/ramp mode section for more details.

When first learning to use the unit it is best to calibrate the unit with a wireless ring before using other features. To do this, put the unit in calibration and place the ring on a flat surface and press it flat before initiating the calibration. This will ensure that both X and Y axes are calibrated normally.

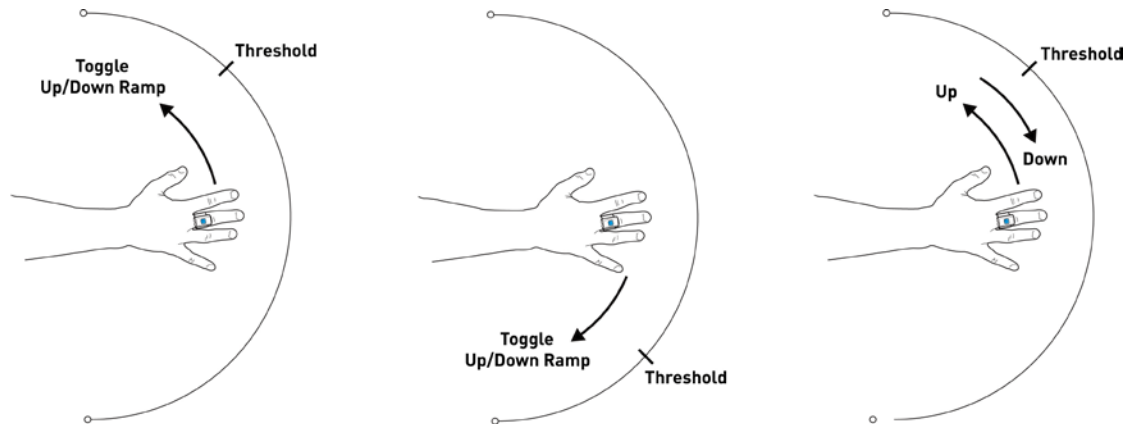
## **Trigger / ramp mode:**

One of the key features on the MIDI-EXP controller is the trigger mode that allows you to start an automatic ramp of the MIDI or expression output when a programmable threshold is reached. The threshold can be reached by making a large deliberate motion or with a quick flick of the wrist. The ramp will run from the ramp start parameter set in the utility bank to the ramp stop parameter. There are 10 possible ramp speeds, the slowest (setting 1) being roughly 2 seconds and the fastest (setting 10) being about 10ms.

A ramp in the output can be very useful for controlling effect parameters such as an LFO speed, pitch shift, delay feedback, or for fading from one sound to another. Since you won't always want the ramp to go from 0 to 127, such as in the case of an LFO speed, the ramp start and stop points can be used to set the desired low and high speeds.

There are two possible trigger modes on the MIDI-EXP. In the first mode, each time the threshold is crossed in one direction the ramp will run toggling from low to high. When the threshold is crossed again in the same manner then the ramp will run from high to low. Essentially this acts as a switch that starts the ramp in one direction or the other.

In trigger mode 2, the ramp will be triggered when the input signal crosses the threshold in both directions. Essentially, the range of the sensor is divided into two zones, separated by the threshold value. When the threshold is crossed on the way up, the output will ramp to the ramp stop value and when the threshold is crossed on the way down it will ramp to the start value. Start and stop values can be easily exchanged by pressing the invert button.



**High Threshold (Invert OFF)  
Trigger Mode 1**

**Low Threshold (Invert ON)  
Trigger Mode 1**

**High Threshold (Invert OFF)  
Trigger Mode 2**

For either mode, if the output value is already ramping and the threshold is crossed again, the ramp will change directions and being moving the other way. There is an indicator light on the main numeric display that turns on when the threshold is reached and stays on until the ramp is completed.

Note Control 2 mode requires one of the trigger modes to function. Every time the threshold is crossed a Note On MIDI message will be sent. The speed at which the threshold is crossed will determine the Velocity value of the Note On MIDI message to be sent. Using this mode effectively requires some time to carefully set the threshold, depth, and smoothing to get the desired response.

### **Expression output:**

The expression output uses a 10kOhm digital potentiometer to simulate a passive expression pedal. Since there is only one expression output, it can only be used with one axis of the accelerometer at a time. The expression output uses whichever axis is currently selected using the Axis button. None of the settings in the Function Bank apply to the expression output. However, when trigger mode is used with the expression output, the ramp parameters (start, stop and speed) will all apply to the output. All button functions (axis, trigger, invert, gain mode) apply to the signal on the expression output. When the footswitch is pressed and the unit is deactivated, the expression output will hold the last value that was set.

With the ability to exchange the tip and ring signals using the switch on the back panel of the MIDI-EXP, the expression output is designed to be flexible and work with most expression pedal inputs. However, expression inputs are not standardized by any means and users should check the manuals for their third party devices to understand what is expected at the expression input.

### Normal mode (Continuous Control) example:

Here is an example of using the MIDI-EXP in normal mode (trigger mode off, invert off, normal gain mode). One common setup used is with a Digitech Whammy pitch shifting guitar pedal in the octave up mode. Both units should be powered up and connected with a MIDI cable. From the Whammy manual you can find that the MIDI message for controlling the position of the treadle is on Continuous Controller 11 (CC 11) and it varies from 0 to 127.

The goal is to set up the Whammy to respond to the X axis of the Hot Hand ring. Start by making sure that the X axis is currently selected with the Axis button. Since the whammy responds to CC 11, set the MIDI-EXP function to Continuous Controller (if it wasn't already there) and use the encoder to select controller number 11. Next, press the footswitch to activate and start sending MIDI messages to control the pitch with the ring. If you're not getting the entire octave range you can then increase the depth so that you can get the range you want with the desired amount of motion. If the sound is too jittery because the pitch is fluctuating with every movement of the sensor you can increase the smoothing to reduce that.

### Trigger mode example:

The following is an example of using the MIDI-EXP controller to a parameter with a triggered ramp. Let's say, you have the MIDI-EXP unit connected to the MIDI input of a processor that is running a Leslie effect that you can control the speed of by writing to CC 27 and you want to ramp between two speeds by making a quick gesture with the Hot Hand sensor.

First, editing the x axis controls, set the function to Continuous Controller and select CC 27 using the encoder and activate the unit. Next put the MIDI-EXP unit into trigger mode 1 by pressing the trigger button once. The first LED labeled "1" will be lit. The unit will be using the default threshold which is set to the midpoint of the x axis. Take your hand and point it at the floor then slowly raise it, when you cross the midpoint of the x axis (the current threshold), the MIDI output will begin to ramp and you should hear the LFO speed increase slowly over two seconds to a maximum value. Since the unit is in trigger mode 1, to get the LFO to ramp back to the minimum speed, you need to repeat the same motion again. Raising your hand from the bottom and crossing the threshold will start the ramp moving the other way. The unit is currently triggering when the sensor input goes from low to high. If you want to trigger the ramp as you move your hand from the up position to the down position, you can turn on the Invert function.

In most cases, you won't want your output ramp to go from 0 to 127. In the case of the LFO it would go from being very slow to very fast and probably wouldn't be desirable. You can adjust this by pushing the encoder to move to the Utility Bank and changing the ramp parameters. First, adjust the ramp start to the desired slow LFO speed, let's say a MIDI value of 38. Next, adjust the ramp stop to the desired high LFO speed of 97. If you don't want the ramp from low to high to take quite so long, adjust the ramp speed to a higher value of 4 or so. As you adjust the ramp parameters, you can cross the threshold with the sensor and try out the new settings.

Now let's try setting the unit to start the ramp with a specific motion. Having the threshold point be right in the middle of the Hot Hand range is not ideal for triggering the ramp with a quick gesture. The likelihood that you would cross that point unintentionally is pretty high. If you press and hold the footswitch for a couple of seconds, the unit will go into Set Threshold mode. **Note that you can only edit the threshold when Trigger Modes 1 or 2 are selected!** If you point the x axis of the sensor up at a 45 degree angle and while holding it there press the footswitch, then you've set a new threshold a much higher point where you are unlikely to trigger it accidentally. You can try out and verify the new threshold by moving the sensor through the full range of pointing down to pointing up until you cross the threshold point.

Since the Hot Hand sensor responds to acceleration, it will respond to both motion and gravity. Gravity is what causes the signal to change while slowly moving the orientation of the sensor. You can create the same response by moving the sensor quickly along whichever axis you're currently using. So, by making a quick flick of your wrist with the sensor, you can generate enough acceleration to cross the new threshold point. By adjusting the depth and smoothing knobs you can finely tune the response of the sensor so you can trigger the ramp only when you want to with a specific motion like a flick of the wrist. Increasing the depth will mean that you have to move the sensor less to get to that threshold. Increasing the smoothing will eliminate fast

transitions of the sensor but require more and more deliberate motions to hit the threshold and trigger the ramp.

The above example is also very useful with a Moogerfooger type analog effects pedal that features an expression input. In that case, use a TRS (stereo) ¼" cable to connect the MIDI-EXP to an expression input.

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