SpaceHarp MIDI Controller

and

Standard Accessories

User Guide

spaceharp corporation

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Acknowledgements

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Chris Adams, David Clark, Jimmy Hotz, Greg Hurley, Ryan Johnson, Ed Sisler and David Warman.

www.spaceharp.com
Los Angeles, CA
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1.1 OVERVIEW

SpaceHarp introduces a new way to create music by sensing players' continuous motions over it. It's an instrument built "from scratch" to fully exploit today's amazing music software tools in a radical departure from previous musical instruments. Applications for SpaceHarp range from public walk-up, self-serve "kiosk" installations, to DJs, Pro performers, theme park installations, therapeutic applications and bedroom musicians.

SPACEHARP CONTROLLER USER GUIDE

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SUMMARY OF SECTIONS

Section 1 Overview (This page.)

Section 2 QuickStart is a handy step-by-step checklist to get you up and playing quickly.

Section 3 Play SpaceHarp illustrates how to play, how to adjust the controller stand, and how the sensors and LEDs work.

Section 4 Standard Accessories details the certified Sound-Galaxy compatible equipment for the standard Stand, Boom & Light Sub-Assembly and the standard Pedal Board Sub-Assembly.

Section 5 Setup Controller and Accessories gives step-by-step instructions, tips and cautions for setup of the recommended Stand, Boom & Light, Pedalboard and the SpaceHarp Controller.

Section 6 Startup SpaceHarp shows how to startup the Controller and start playing it.

Section 7 Troubleshoot gives you precise and quick step-by-step help for getting out of trouble.

Section 8 MIDI Specification describes the MIDI features and message specifications for the SpaceHarp LE Controller.

Section 9 Hardware Reference covers controller connections and controls, MIDI specification, hardware specifications, and a cross-index table of all system devices & sub-assemblies.

Section 10 Benefits describes the benefits to the player of using the SpaceHarp Controller.

NAVIGATING THIS GUIDE

You have three ways to jump to any section of this User Guide. (1) Open the bookmarks pane in your PDF viewer. (2) Use the Table of Contents which is hyperlinked. (3) Use the right margin thumb-tabs which are linked.

1.2 QUICKSTART

This is a condensed checklist of steps needed to get to normal SpaceHarp play, from a hardware system that has already been setup, cables connected, and that is ready to power ON. This may be after transport and setup, or, after a system that was previously operating, has been completely powered down (all devices and AC power turned "OFF.")

Cautions and other potential issues are not listed here.

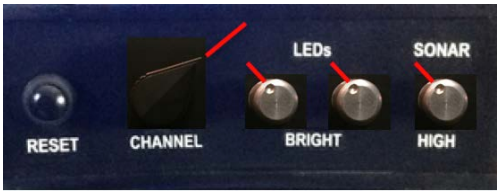
See Startup SpaceHarp for details.

STEP (1) Make sure Sensor Illuminator Light is turned OFF (in-line dimmer switch is all the way down, and you don't see any light coming from the overhead fixture);

STEP (2) Only if necessary for a very short or very tall player, Adjust Stand for Player Height.

STEP (3) Turn ON the Sensor Illuminator Light (slide its in-line dimmer switch up to maximum);

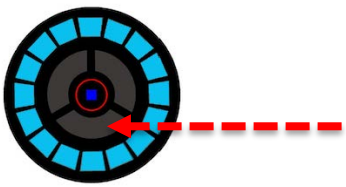
STEP (4) Make sure the SpaceHarp knobs at the controller right front are turned to their "best practice" positions: Channel knob at 2 o'clock position; LED BRIGHT and Sonar knobs all set at 10 o'clock position. (If you have previously established other settings for your setup, make sure they are what you want.)



STEP (5) Turn ON the SpaceHarp with its Power button (located behind the "Stage LEDs");

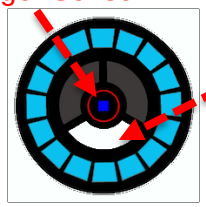
STEP (6) Move back (don't shadow the controller) and let the Power-up LED Animation complete;

STEP (7) All the Trigger LEDs (inner/lower) should be OFF (dark), if 1 or 2 inner/upper LEDS stay lit after startup that's okay, ignore them, they'll clear when the first Sound Galaxy Song STARTS.



All the lower/Inner LEDs ("Trigger LEDs") should be dark, when not shadowed.

STEP (8) Move over the SpaceHarp's shadow trigger sensors. The trigger LEDs (the lower, inside LEDs) light up white when you pass over their associated nine Trigger Sensors;

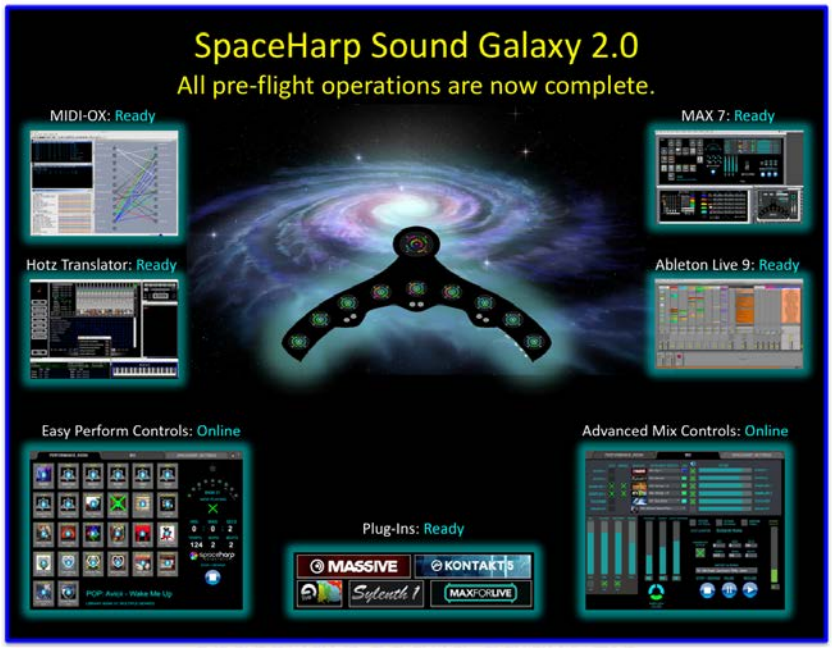


If some shadowed Trigger LED's stay dark (shown above), and/or some un-shadowed LEDs stay white, then you probably need to Re-Adjust your Stand/Light Setup. Otherwise, see Troubleshooting.

STEP (9) (Optional) For a "darkest" setup, slide the Sensor Illuminator Light's in-line dimmer slowly down, until one or more Trigger LEDs turn white; then move it slowly higher again, just until all Trigger LEDs turn back OFF (dark). Now you have the darkest possible operating setup.

STEP (10) See the external document **Sound Galaxy 2.0 User Guide: Quick Launch Checklist.**

When **Sound Galaxy 2.0** is loaded, you should see this Splash Screen.



Alternate **STEP (10)** Or, if you have a custom software setup without the full Sound Galaxy Suite, proceed to launch it.

1.3 PLAY SPACEHARP

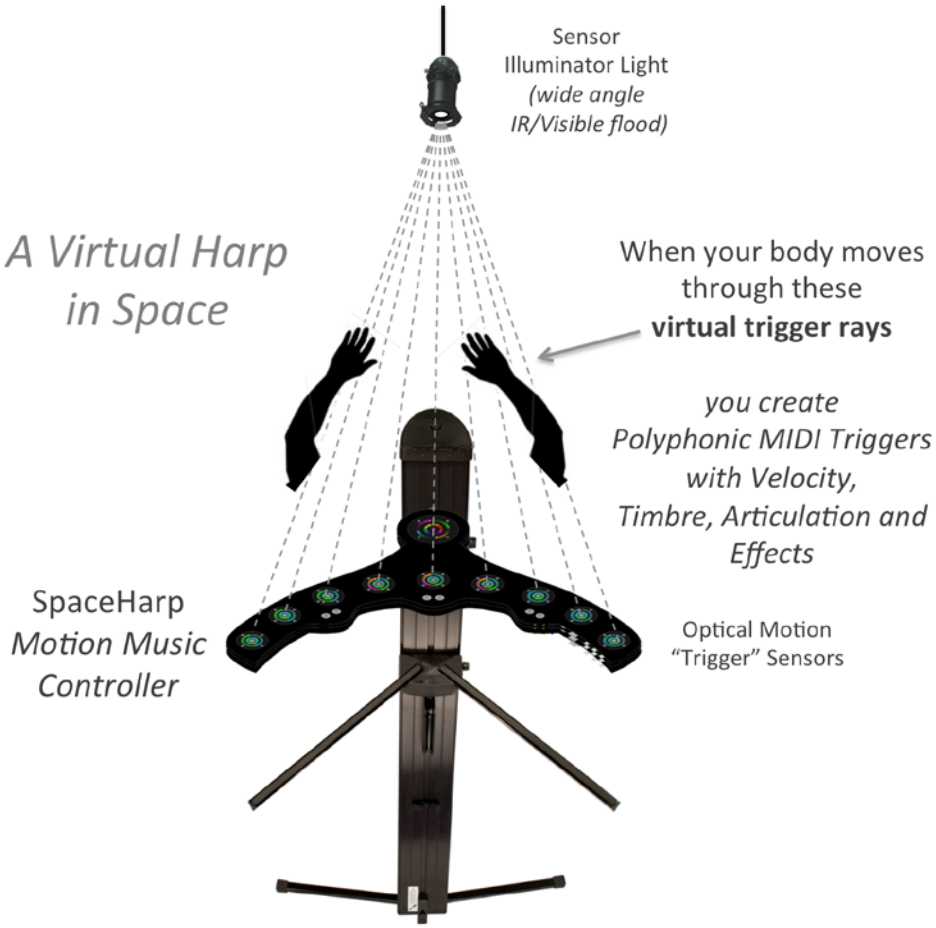
1.3.1 Trigger (Shadow/Unshadow) Sensors

The SpaceHarp controller has nine (9) motion or "Trigger" sensors, which detect a player's shadowing and unshadowing movements over them. Since the shadow is formed by a point source light, moving your shadow over a sensor turns out to be identical to playing "invisible strings" in space.

1.3.1.1 Virtual Harp Strings in Space

SpaceHarp's patented sensor setup provides a unique, high-precision "through-beam" sensing architecture. This is more articulate, accurate and robust than reflective-type sensing methods for triggers, and, it is precisely polyphonic. You can strum "in space" effortlessly by rolling your fingers and so forth, as we show in Using Different Parts of Your Body.

The SpaceHarp's active sensing region is very large, with no sacrifice in precision. This encourages larger and sweeping motions, creative expression, and unhindered spatial freedom while playing. Depending on the distance between the SpaceHarp and its overhead Sensor Light, total active sensing volume ranges from one to four cubic meters in space. When adjusted for a larger space, know that it is equally as precise as a smaller volume.



1.3.1.2 Player Reference Shadow

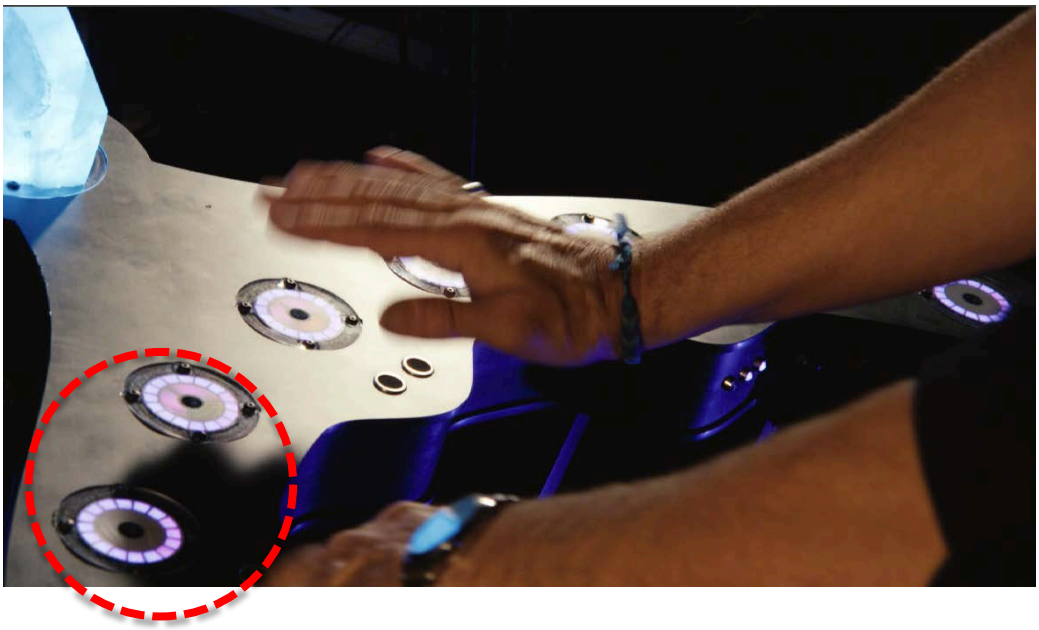
You can't see the "strings" however, you can clearly see your shadow. They are equivalent!

Since our miniature halogen lamp has a "point source" and has plenty enough brightness, it provides a visible shadow of your body. This shadow is a major help to you.

You can adjust how clear the shadow is, by using various gels in the Sensor Light Gel Holder, and by Re-Adjusting Sensor Illuminator Light.

The Player Reference Shadow provides:

- An equivalent visual reference to the virtual strings, but without needing fog in the air.
- An effortless means of instantly and intuitively learning where to trigger sensor events while moving in space. Everyone is a "shadow virtuoso" even as a small child.
- Virtuoso polyphonic triggering precision, such as for un-quantized percussion playing. See Section on **Time Quantization** in **Sound Galaxy 2.0 User Guide.**



1.3.2 Ways of Generating Motion Triggers

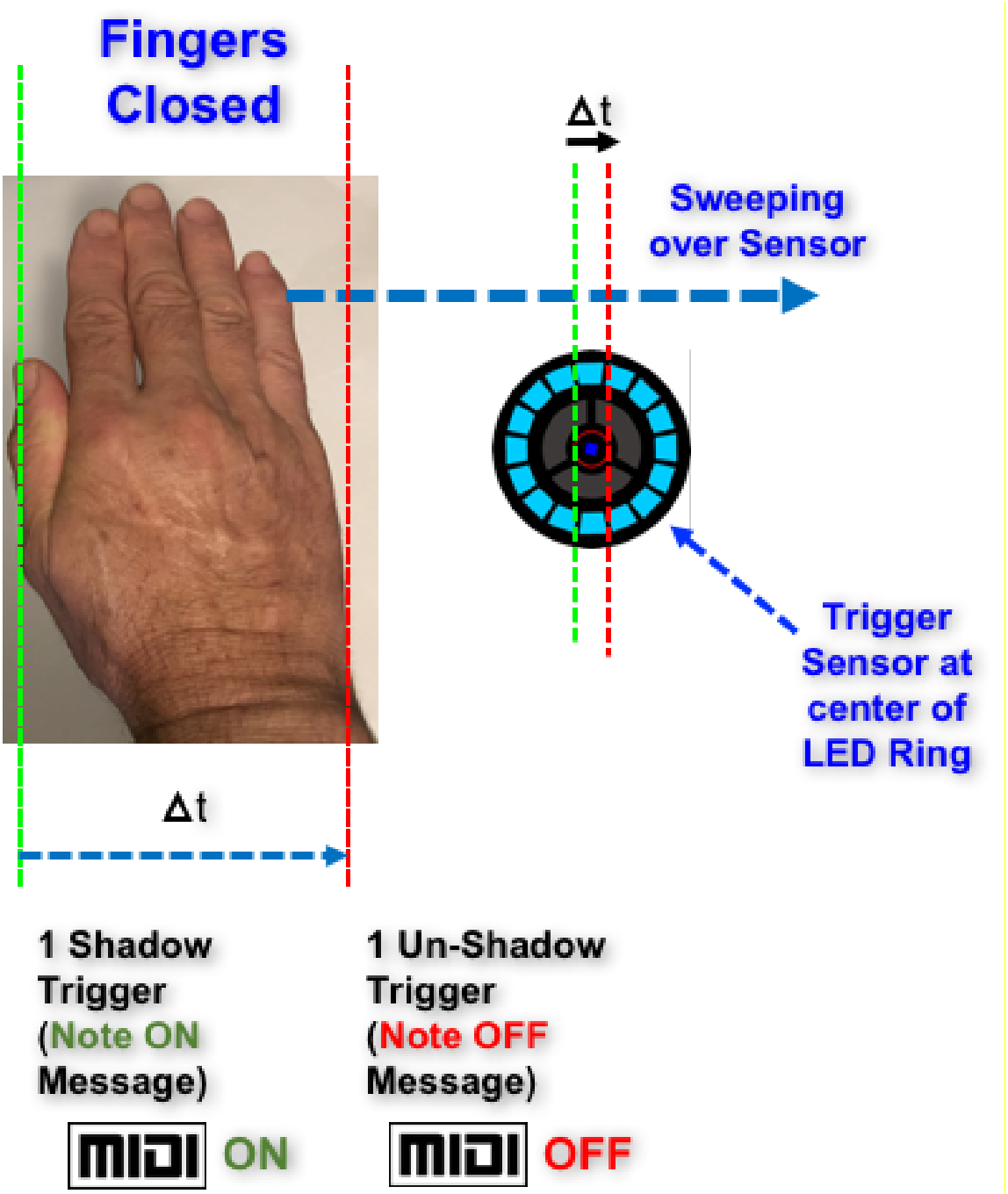
1.3.2.1 Using Different Parts of Your Body

With a little experimentation and practice you'll quickly understand the result of playing with different parts of your body and in various ways. Most of them are equally effortless. We designed the SpaceHarp's shape, Sensor Light and the spacing of its Sensors to maximize physically effortless play while maintaining total precision.

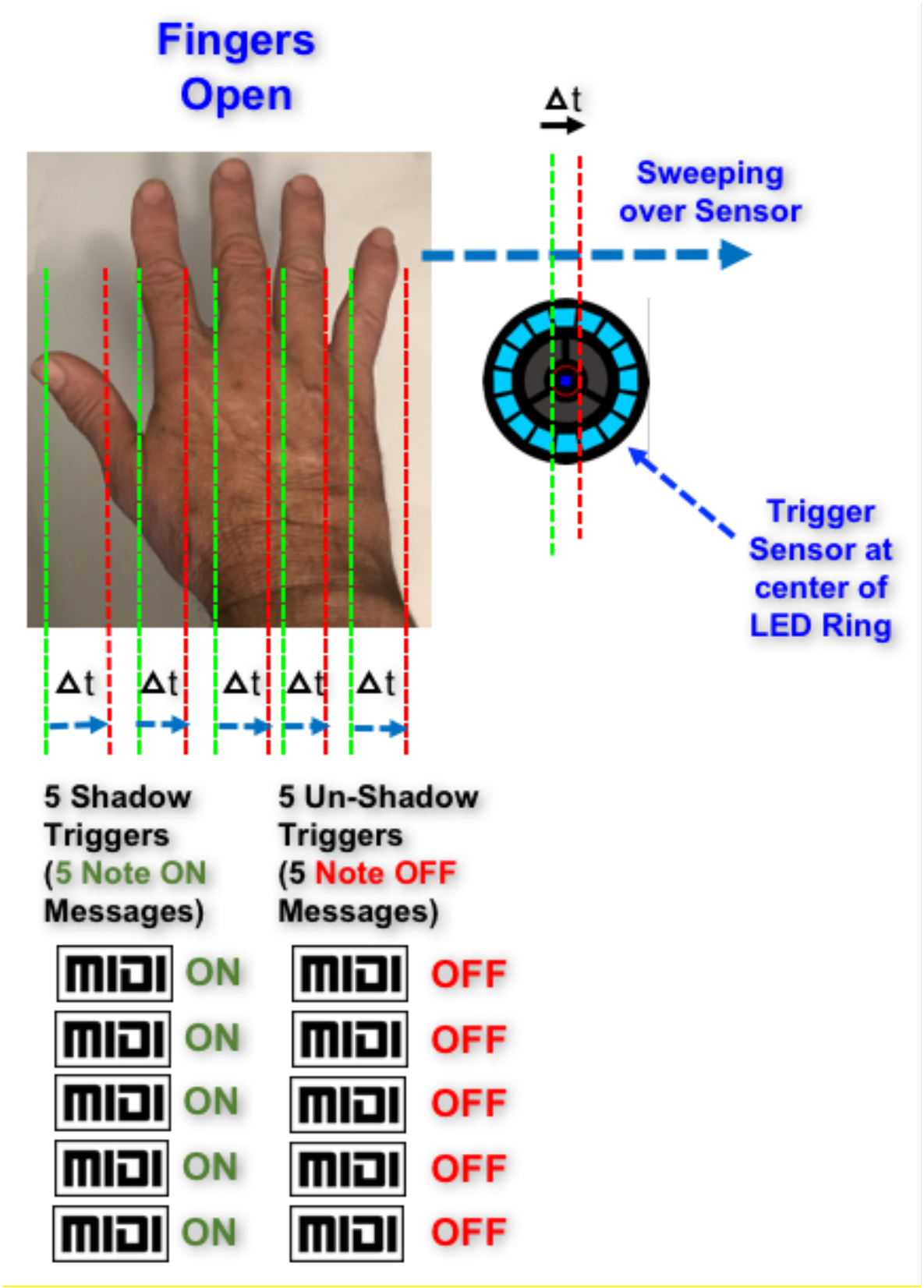
Here we'll quickly lead you through each of the significantly different methods of playing. Once you try these, you'll naturally find that you'll experiment and freely use them in your SpaceHarp sessions.

STEP (1) Boot up your DAW System; Sound Galaxy 2.0 or otherwise. If you're using the Sound Galaxy turn-key remote controls and our easy Performance Tab, simply tap on any Song Start Button for the Song Library you have open. If you're using a customized DAW system, then START whatever is the "master transport," in your setup, so that our "Notes Processor" MAX patch will run. Then you can play while using our powerful and automatic time-quantization, auto-sustain and LED feedback control (even if other parts are custom.)

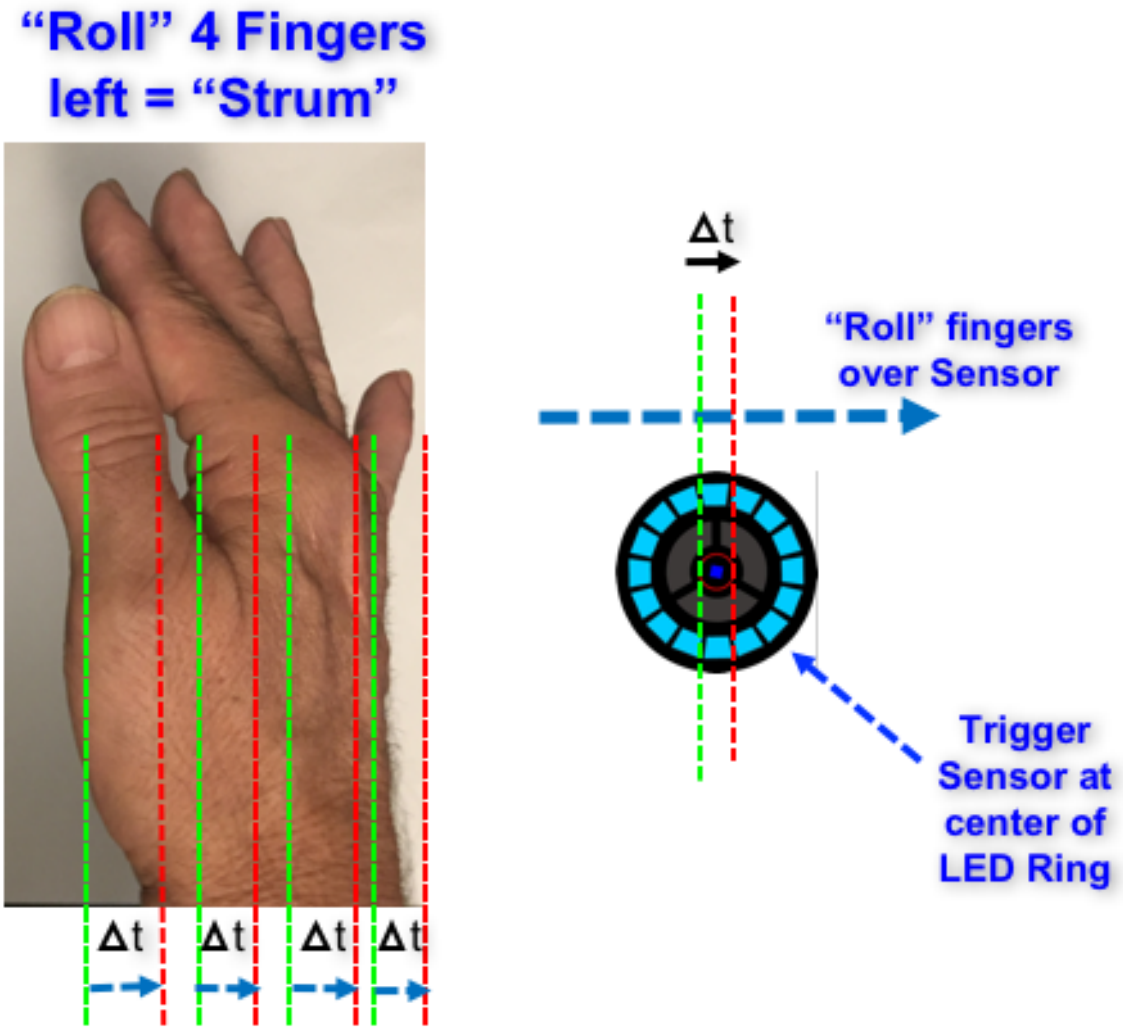
STEP (2) Move your hand(s) over the Trigger Sensors with fingers together and palm facing down or up (vs. sideways). This will generate only a few notes. Try it. This is because there are only two shadow transitions for one hand motion over a sensor: essentially, on and off.



STEP (3) Now, try sweeping your hands over the Trigger Sensors with fingers spread open. You'll hear as many as 4 or 5 triggers (depending on how fast you move) per each sensor, since there's an "on and off" trigger *for each finger separately.*

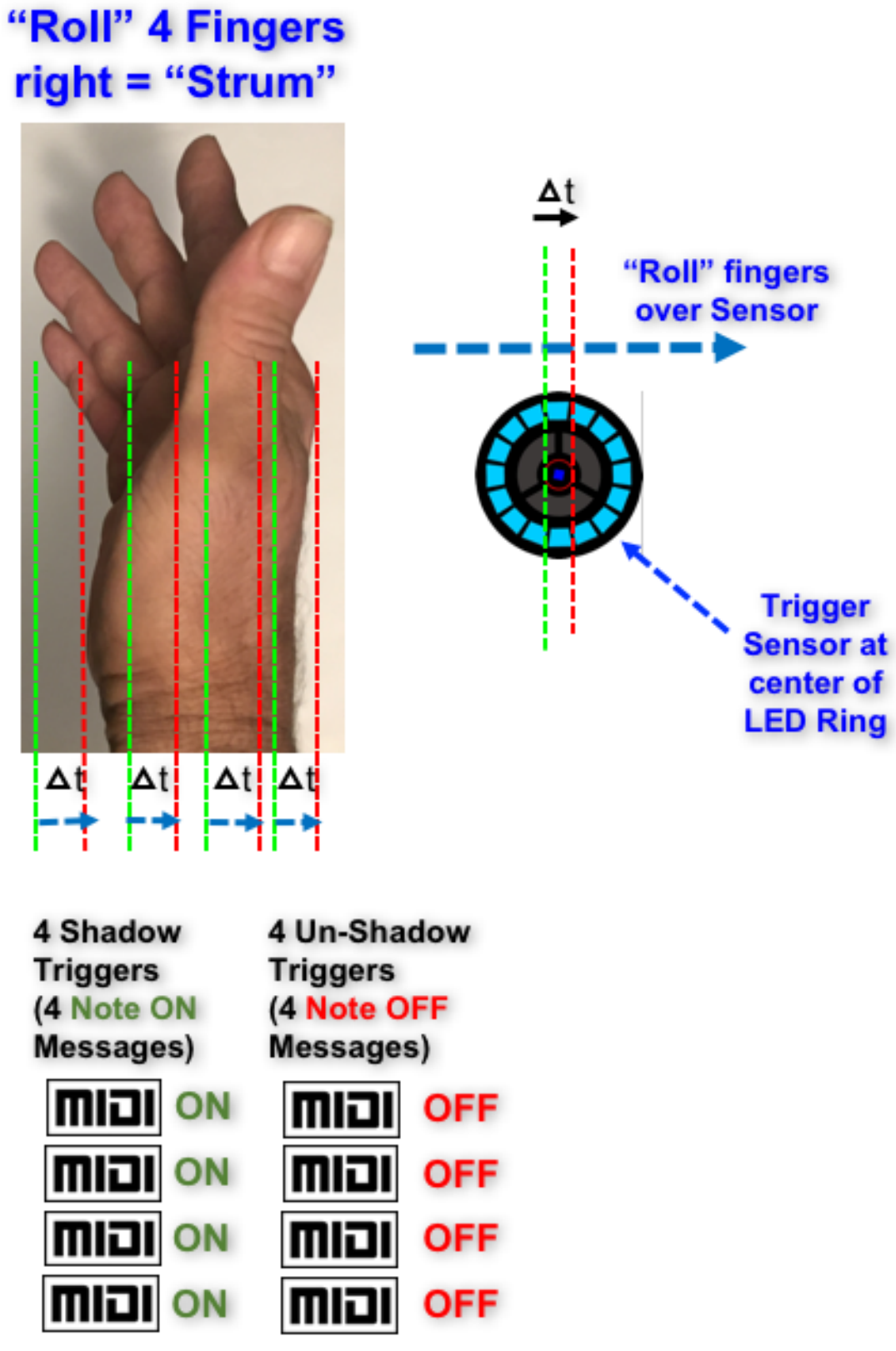


STEP (4) Strumming on one “string” at a time is amazing on SpaceHarp, and it’s effortless! Simply turn your hand thumb-up (sideways) and roll your fingers with your hand over any sensor. Now try it with both hands. Now try it while also moving over various sensors. With a little practice, you’ll find that rolling the fingers back and forth, generates eight (8) triggers!

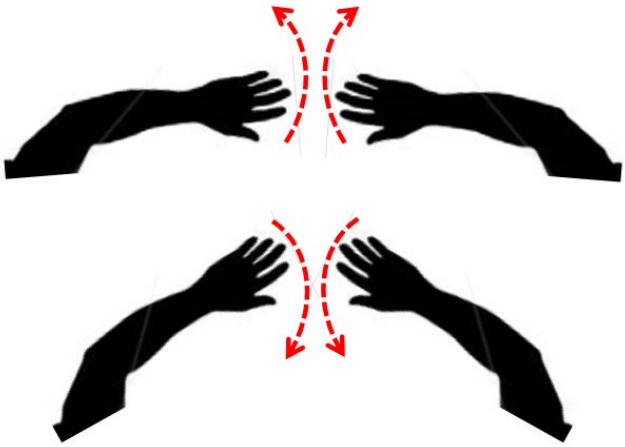


4 Shadow Triggers (4 Note ON Messages)	4 Un-Shadow Triggers (4 Note OFF Messages)
MIDI ON	MIDI OFF
MIDI ON	MIDI OFF
MIDI ON	MIDI OFF
MIDI ON	MIDI OFF

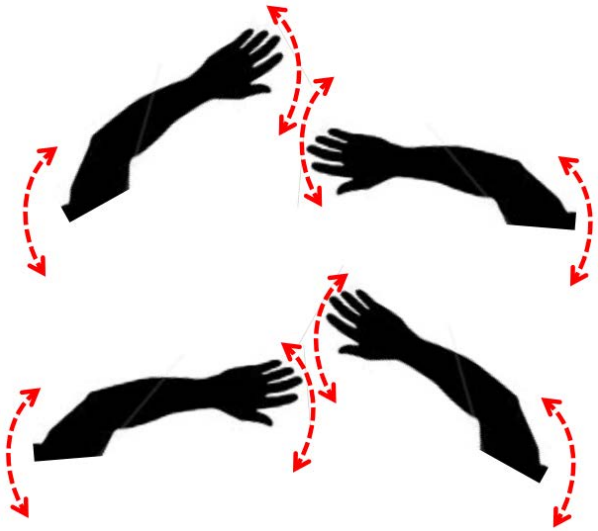
The exact way this behaves in musical response depends upon the Sound Galaxy Time Quantization setting in the Mix Tab. If the Quantization is fast (16th, 32nd, 64th notes, etc.) you'll have all the triggers; if quantization is set slow (quarter, eight notes) there may be fewer separate triggers. (System clock tempo affects the actual strum timing in practice; real-time quantization is relative to master tempo).



STEP (5) Now try using more of each arm, not just your hands. Move up so your whole arm(s) are along the edge of the SpaceHarp. You'll find you can move an entire arm over many or all the sensors, to play a "chord" or whatever other multi-trigger effect is setup. (How many notes depend on the polyphony setting of the DAW instrument Preset that's loaded. The controller itself supports up to the full 9-trigger-sensor polyphony).



STEP (6) Here's a unique SpaceHarp move: we call it the *"SpaceHarp Wobble."* It's a way of generating complex trigger arpeggios across the "virtual strings" with simple arm motions. Hold one or both arms such that your shadow edge of your whole arm is just inside (below) all (or several of) the sensors at once. Keep relaxed, not stiff. Now loosely "wobble" your arm(s) horizontally in and out, allowing your elbows to naturally bend as you move. You'll quickly find that varying the in/out timing between your two arms results in several different variations of arpeggios. With practice, these can be duplicated with considerable precision!



STEP (7) Now try any of the above shadow trigger moves, at all the heights between the surface of the controller and to within a few inches of the Sensor Light. Watch your shadow. You'll quickly see that the sensing regions, namely the virtual invisible strings, form a 'trigger cone' that becomes more and more narrow in space the higher up you move. Practice how you can generate different densities of note triggers by playing at these different heights. This has nothing to do with the Sonar Sensors, it's a function of our Light-to-Shadow geometry. Playing higher up allows a greater density of triggers in a smaller space.

STEP (8) Finally, experiment with using your head or even torso to trigger. Realize, however, this may dramatically affect your "height" sensing parameters, so also try this again in the next series of "how-to-play" STEPS in the Methods of Play and Height Sensing.

1.3.2.2 Using Props

Any object that is opaque enough to make a shadow that moves between the overhead Sensor Light and any Trigger Sensor on the SpaceHarp, thus making a shadow over the sensor, will generate a trigger event. Thus, SpaceHarp play is not limited to your body!

Any of the following can be used to generate SpaceHarp triggers, in addition to a human body. In all cases realize that you can develop considerable control and precision of play even with any of these props; there is no necessity to "dumb down" the musical results – at all!

- Hair
- Feathers
- Hats
- Scarves, fashion accessories
- Wands
- Fans

1.3.2.3 Use by Special Needs and Amputees

SpaceHarp is a musical instrument that can be played by amputees and by those with motor control issues. Even with missing fingers, given some practice using hands, arms and in some cases props, excellent and complex musical results can easily be achieved. This is because any part of the body (or prop) will always make a sharp shadow edge.

However a player *is* able to move their body (or prop), *that motion* can be done deliberately. So, without sacrificing repeatability and precision of result, a literally endless variety of body (or prop) positions and moves can be used *with completely deterministic results.* Nothing at all is random, one just pays attention to the Player Shadow and the controller's LED responses to the extent desired. Musical (and other connected visual media) responses will be 100% repeatable.

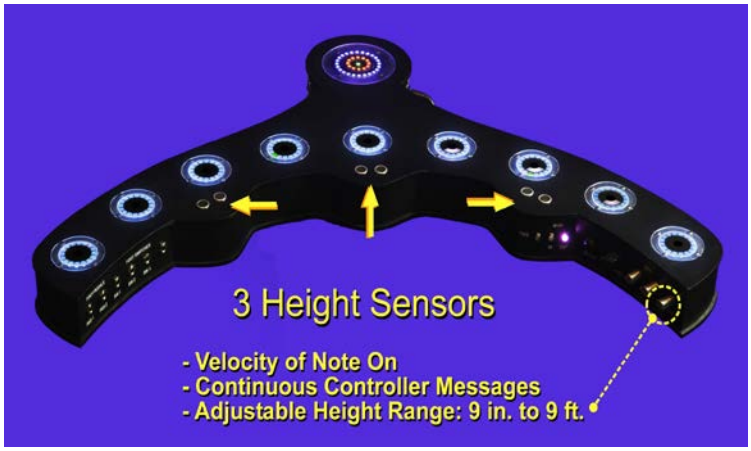
The harmonic and aesthetic results will always be a positive feedback to the player as well as enjoyed by on-looker(s) (or therapist) thus boosting self-esteem of the player immediately and continually.

This is obviously NOT the case for virtually all other musical instruments! The nature of the shadowing geometry, together with the time-quantization of our Max patches, and with the harmonic engine of Hotz Translator, SpaceHarp gives those with special needs the ability to produce rhythmic, harmonic and melodic results – every time.

1.3.2.4 Triggers Control MIDI-Connected Visual Media

All of the trigger methods we explain here, when a SpaceHarp is also used to control MIDI-driven visual media, also control the effects and animations of those visual media simultaneously.

1.3.3 Height (Sonar) Sensors



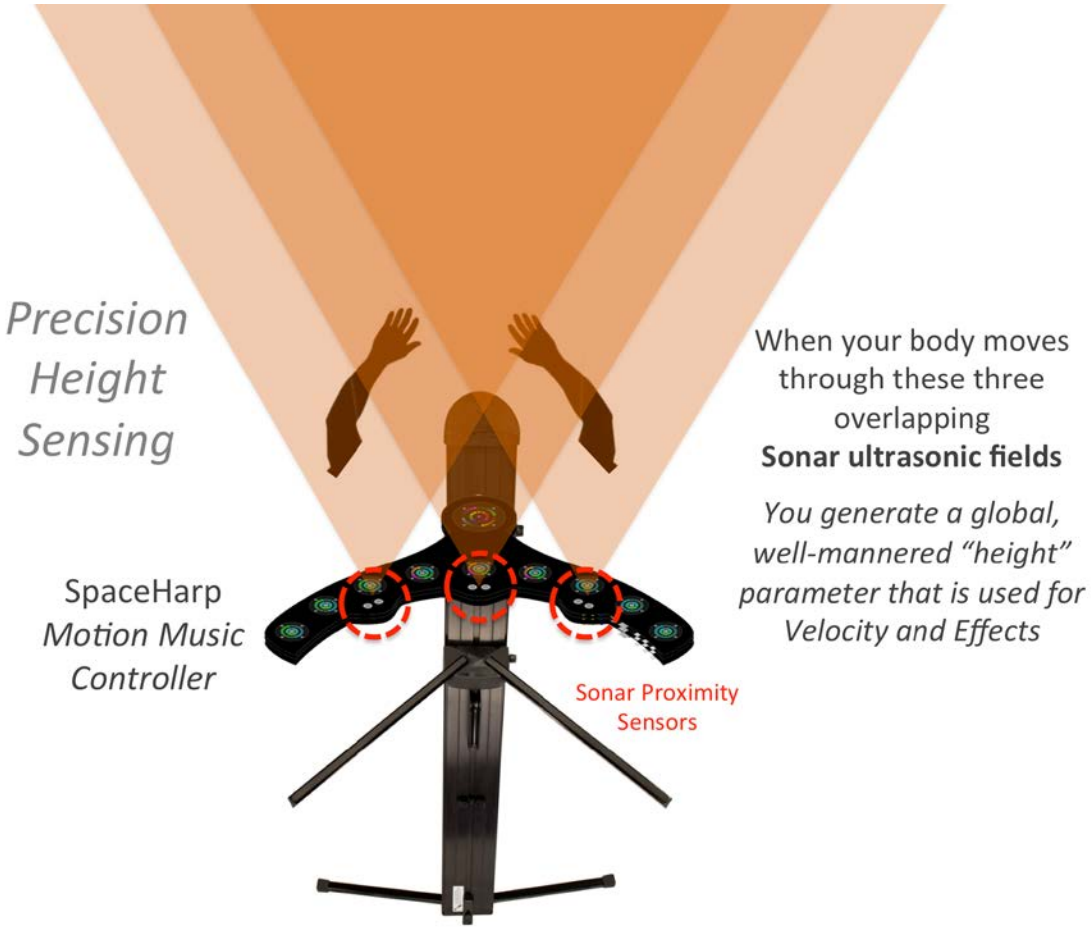
SpaceHarp's height sensors work together to provide one uniform, very robust, and adjustable, measure of a body's (or any shadowing object's) height above the surface of the SpaceHarp controller.

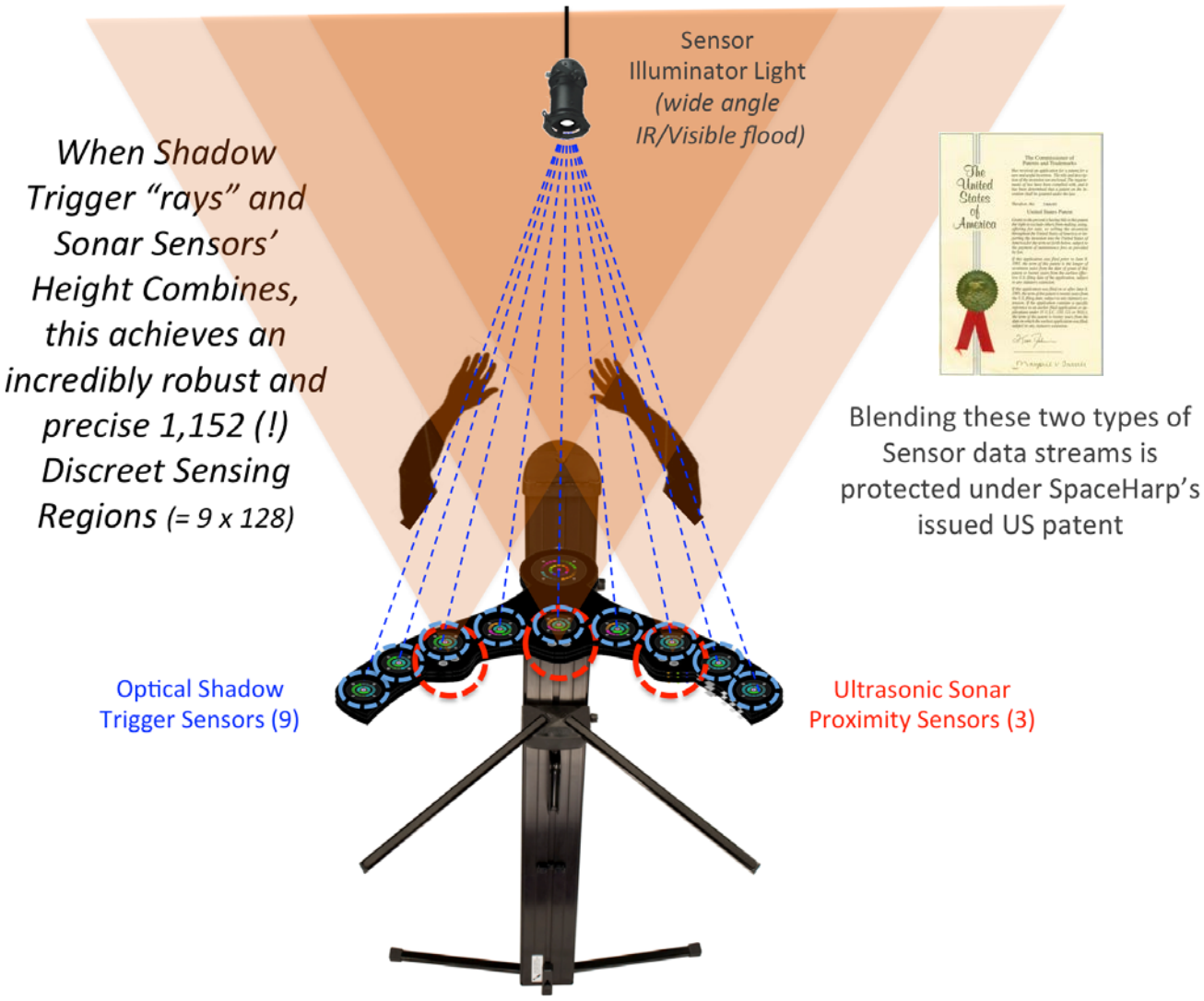
SpaceHarp includes an array of three ultrasonic, sonar-based height (distance) sensors. The three sensors overlap in space and fill several cubic meters over the controller.

SpaceHarp has a proprietary means of smoothly "blending" the array's information that provides one robust, flexible and super-obvious global height parameter.

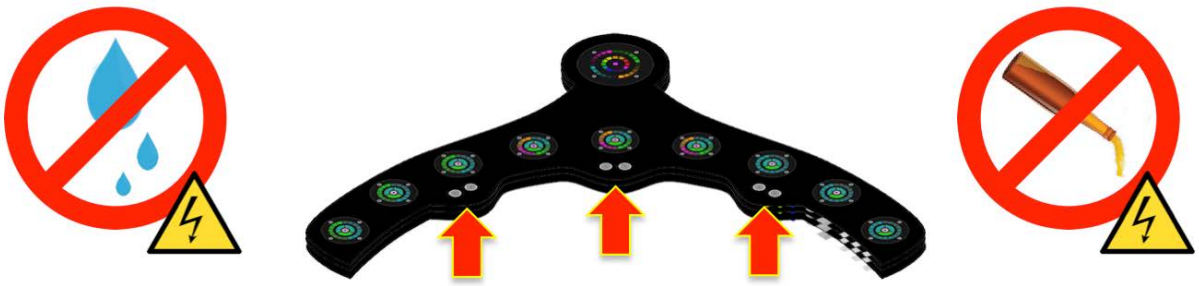
The Sonar Sensors provide:

- Notes "Velocity" impacting sound timbre and custom 'articulation' effects. (See **Instruments** Section in the **Sound Galaxy 2.0 User Guide**.*)*
- A global height continuous controller MIDI stream (Controller ID=15), which is used to achieve nuances, effects, arpeggiation parameters and more.
- A high precision and nicely "throttled" MIDI controller stream, providing smooth single-digit controller value ramps, without being too overbearing in message density on the MIDI channel.





WARNING: AVOID SPILLING LIQUIDS directly into the Sonar Sensors. This could potentially damage the SpaceHarp controller hardware, or possibly pose a shock hazard.

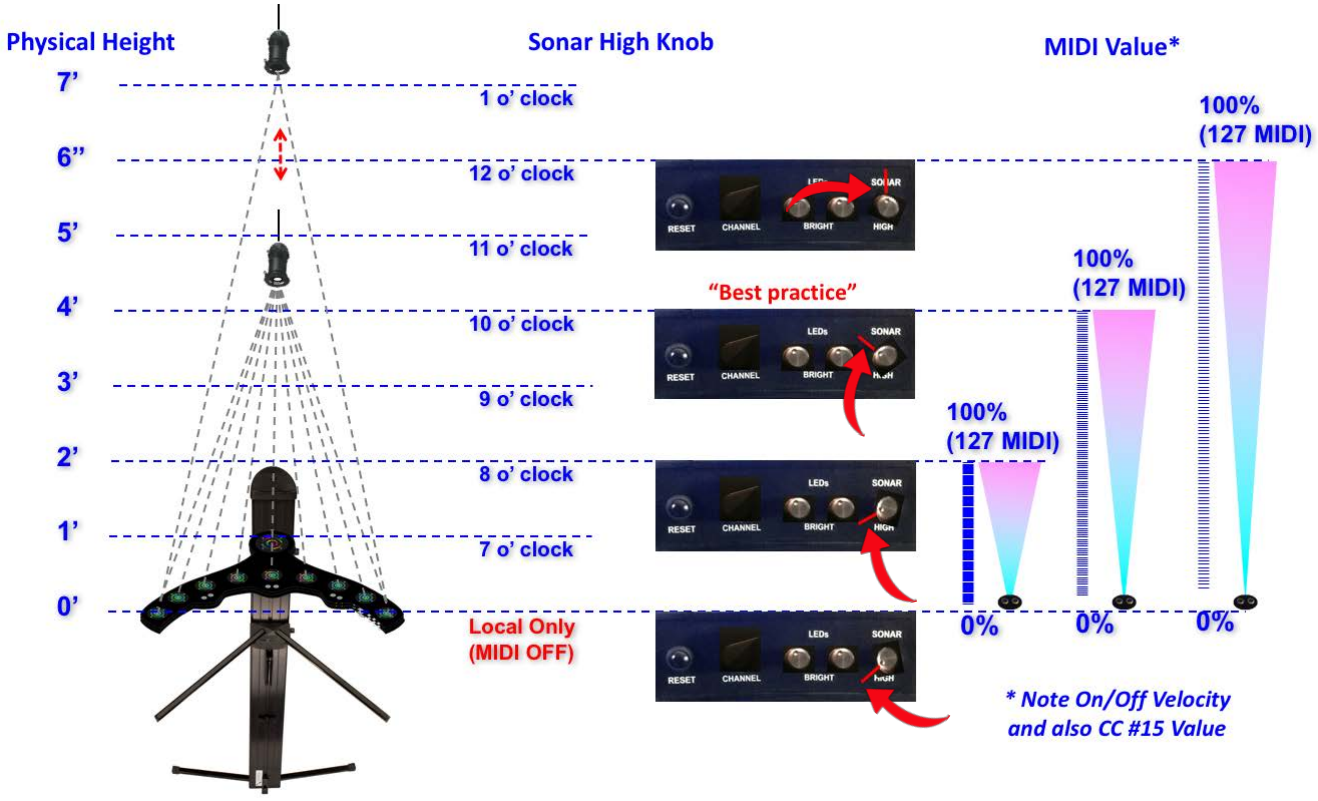


1.3.4 Methods of Play and Height Sensing

1.3.4.1 Height Sensing and Controller MIDI Out

1.3.4.1.1 Sonar Auto-Scaling of MIDI Response to Sonar High Setting

No matter what height the Sonar knob is set to the MIDI range of 0-127 is always scaled over the physical range. The Sonar HIGH setting only adjusts the physical upper limit the Sonar produces messages from. The Note Velocity value corresponds to a percentage that's the ratio of the trigger height to the whole active Sonar Range. Thus 0-100% of the (active) height always corresponds to Note Velocity of 0-127. Adjusting Sonar Height never truncates the MIDI upper range of Velocity values.



1.3.4.1.2 Note On Message Velocity

When shadow and un-shadow triggers occur, the SpaceHarp automatically outputs each trigger's MIDI Note ON Messages and corresponding Note OFF Messages, each with a Note Velocity value corresponding to whatever height the shadowing object was at when it generated the triggers.

Note Velocity affects most all sound modules timbre and volume response, whether for virtual Plug-In DAW instrument, or into an external MIDI hardware sound module. For some instruments, the difference in timbre can be very dramatic.

1.3.4.1.3 Continuous Controller Messages CC#15 for Height

In addition to Note On, Note Off Message Velocity, the SpaceHarp outputs a MIDI message for sonar height using continuous controller ID#15.

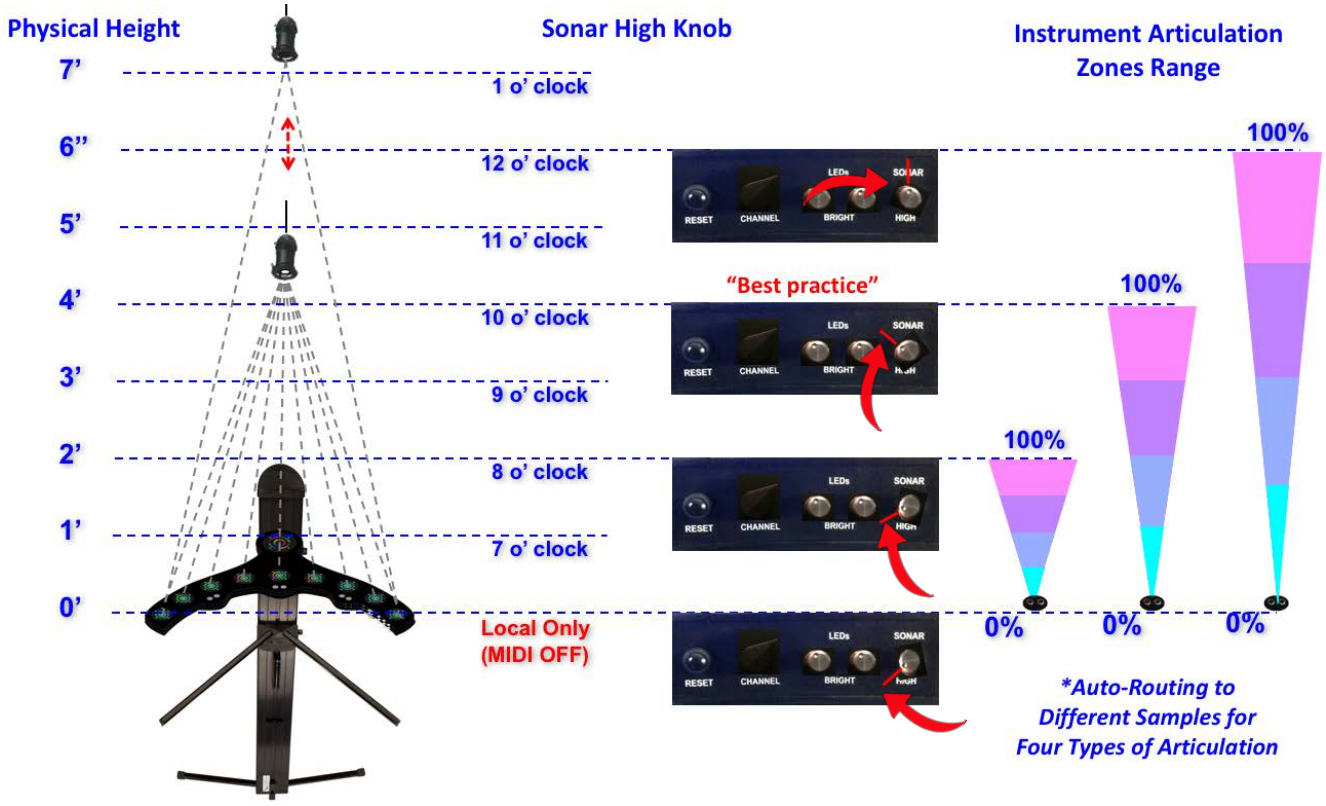
Sound Galaxy 2.0 Instrument Preset Packs provides fully pre-configured options for effects routing, especially for the Massive and Sylenth Plug-Ins. See **Sound Galaxy User Guide, Instruments**.

Otherwise, CC#15 message stream can be routed to whatever parameter(s) you'd like in your custom DAW setup, for modulation or anything. This CC message stream is always generated when anything comes into the Sonar field, and stops when there's no object within its range of sensing.

1.3.4.1.4 Automatic 4-Height-Zones Instrument Articulation

For many instruments, particularly strings, brass and winds, there are many ways to attack or articulate the sound. Thus, using one single kind of sample for any of these instruments makes the realistic range of attacks unavailable. Modern Samplers including Ableton Live and Kontakt, partially address this situation, but in a very un-natural and inconvenient way. These require a second player action to tell the system WHICH attack you want, THEN press the piano keys or other controller. This double action requirement breaks the "flow" of playing, and it's easy to make mistakes, or is just too much hassle to bother with – except in strictly managed recording sessions. Not for live performance!

SpaceHarp fully solves this problem, by implementing an **Automatic Four-Zone Articulation** for many of its DAW Sampler Instruments. Sound Galaxy's custom MAX Patch logic combined with our Ableton Template setups automatically produces four alternative articulations for these instruments. A SpaceHarp trigger's height translates into four "vertical zones" or "spatial layers" of articulation. That is, over a Sonar Range of 100% the four "zones" or "layers" represent 0-25%, 25%-50%, 50%-75% and 75%-100% of that active height range, respectively.



Not all instruments have this capability, but Sound Galaxy 2.0 Packs 01 support a total of nine (9) orchestral instruments with this feature.

Kontakt ('SAMPLER 1') in Sound Galaxy Preset Packs provides this for **Strings 1-A** and **Brass-A** Presets.

Ableton Live's Sampler ('SAMPLER 2') in Sound Galaxy Preset Packs, provides these Presets:

- **Strings 1-A** Legato, Tremolo, Staccato and Pizzicato;
- **Brass-A** Legato, Mute Legato, Sforzando and Staccato
- **Oboe-A** Legato Vibrato, Legato, Trills and Staccato
- **Horn-A** Legato Vibrato, Legato, Trills and Staccato
- **Bassoon-A** Legato Vibrato, Legato, Trills and Staccato
- **Clarinet-A** Legato Vibrato, Legato, Trills and Staccato
- **Flute 1-A** Legato Vibrato, Legato, Trills and Staccato

See the **Sound Galaxy 2.0 User Guide**, Instruments Sections for further information.

1.3.5 LEDs

SpaceHarp™ MIDI Controller: LEDs

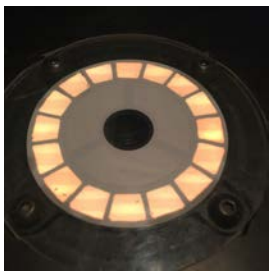
Precision Visual Feedback: Before, During & After Triggering

	1 Instrument Layer	2 Instrument Layers	3 Instrument Layers	4 Instrument Layers	How LEDs Respond to Your Actions
Pre-Trigger					Before a Shadow Trigger, the Outer LED Ring around each Sensor shows how many instrument layers are enabled for that SpaceHarp: 1, 2, 3, or 4, and the colors match Delta Matrix layer colors.
Shadow Trigger					When a hand, arm, leg, head, anything shadows, the lower inside LED Lights up - and that LED's color shows the sonar height, which is Note Velocity.
Hold or Re-Attack					Holding a Note Shadow or re-triggering during an Auto-Sustain lights all inner LEDs.
Auto-Sustain					While a Note Auto-Sustains but is no longer shadowed, only the inside upper LEDs light up.

1.3.5.1 Outer "Ring" LEDs

SpaceHarp's "Ring LEDs" surround each Trigger Sensor with sixteen color-changing LEDs. We use these with our Sound Galaxy color palette of 128 hues, in order to correspond with 128 instrument presets available to any software (DAW) musical instrument at one time. These are strictly to indicate the instrument setups as they are changed by Song Automation or by Player choices. These LEDs remain unchanged by player shadowing actions.

The currently enabled DAW modules' instrument presets are displayed by color on the SpaceHarp's Ring LEDs. Depending on number of currently "live" or active DAW modules (1-4), each "ring" preset color uses 100%, 50%, 33% or 25% of the "ring."



One DAW Instrument Active

Two DAW Instruments Active

Three DAW Instruments Active

Four DAW Instruments Active

For **SYNTH 1** and **2**, **SAMPLERS 1** and **2** and **VOCODER**, their pre-loaded 'favorite' presets are assigned over 128 available SpaceHarp "Ring" LED colors, and those hues are evenly spaced over the color spectrum for easy recognition.

SYNTH 1 and **2** are more of a free-form color assignment (having arbitrary comparison to conventional instruments).

SAMPLER 1 and **2** (including mostly realistic instruments) use a "most-similar" 128-hue mapping to 128 General MIDI instrument categories. Banks may be used, but similar voices are "stacked" into the most similar General MIDI "Program Change" numbers.

DRUMS are an example of external MIDI hardware as a "external" instrument and are not reflected in Ring LEDs. However live SpaceHarp play with such external instruments is nonetheless fully reflected in the nine sets of "Inner LEDs" located around the trigger (shadow/unshadow) sensors. The Hotz Translator harmonic engine does not process these drums, but player drum attacks are processed by time-quantization and auto-sustain logic. See **Sound Galaxy 2.0 User Guide/MIDI API** for details on public IAC bus MIDI specifications for drums and other externally connected equipment.

1.3.5.2 Nine "Inner" LEDs

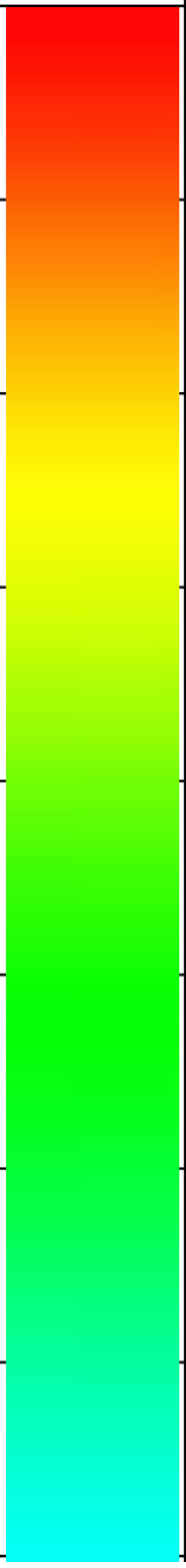
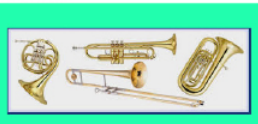
SpaceHarps patented LED responses for the "inner" LEDS at each sensor clarify the trigger actions made by players. Clear visual feedback is provided independently, sensor-by-sensor, for the status of Pre-Trigger, Shadow Trigger, Hold or Re-Attack Trigger, and Auto-Sustains. The unique and patented time-quantization logic employed encourages players to make continuous motions over the sensors without giving up precision.

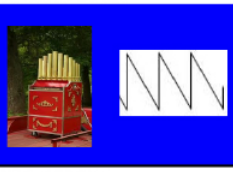
The "Upper" Inner LEDs show time quantized, auto-sustained responses (musically conditioned)

The "Lower" Inner LEDs show "raw" triggers for each sensor, namely shadow/unshadow actions

1.3.5.3 LED Ring Colors for General MIDI Instruments

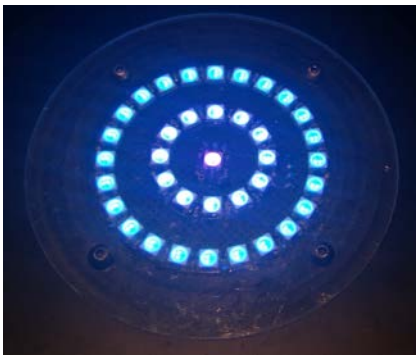
SAMPLER 1 and **SAMPLER 2** soft instrument Plug-ins, including for KONTAKT and LIVE PACKS, where applicable are organized to these General MIDI categories and these LED hues:

(16 COLORS)	INSTRUMENT NAME	HUE	MIDI PROGRAM CHANGE #
Piano: 	1 Acoustic Grand Piano		0
	2 Bright Acoustic Piano		1
	3 Electric Grand Piano		2
	4 Honky-tonk Piano		3
	5 Electric Piano 1		4
	6 Electric Piano 2		5
	7 Harpsichord		6
	8 Clavinet		7
Chromatic Percussion: 	9 Celesta		8
	10 Glockenspiel		9
	11 Music Box		10
	12 Vibraphone		11
	13 Marimba		12
	14 Xylophone		13
	15 Tubular Bells		14
	16 Dulcimer		15
Organs: 	17 Drawbar Organ		16
	18 Percussive Organ		17
	19 Rock Organ		18
	20 Church Organ		19
	21 Reed Organ		20
	22 Accordion		21
	23 Harmonica		22
	24 Tango Accordion		23
Guitars: 	25 Acoustic Guitar (nylon)		24
	26 Acoustic Guitar (steel)		25
	27 Electric Guitar (jazz)		26
	28 Electric Guitar (clean)		27
	29 Electric Guitar (muted)		28
	30 Overdriven Guitar		29
	31 Distortion Guitar		30
	32 Guitar harmonics		31
Bass: 	33 Acoustic Bass		32
	34 Electric Bass (finger)		33
	35 Electric Bass (pick)		34
	36 Fretless Bass		35
	37 Slap Bass 1		36
	38 Slap Bass 2		37
	39 Synth Bass 1		38
	40 Synth Bass 2		39
Strings: 	41 Violin		40
	42 Viola		41
	43 Cello		42
	44 Contrabass		43
	45 Tremolo Strings		44
	46 Pizzicato Strings		45
	47 Orchestral Harp		46
	48 Timpani		47
Strings & Voices: 	49 String Ensemble 1		48
	50 String Ensemble 2		49
	51 Synth Strings 1		50
	52 Synth Strings 2		51
	53 Choir Aahs		52
	54 Voice Oohs		53
	55 Synth Voice		54
	56 Orchestra Hit		55
Brass: 	57 Trumpet		56
	58 Trombone		57
	59 Tuba		58
	60 Muted Trumpet		59
	61 French Horn		60
	62 Brass Section		61
	63 Synth Brass 1		62
	64 Synth Brass 2		63

(16 COLORS)	INSTRUMENT NAME	HUE	MIDI PROGRAM CHANGE #
Reeds: 	65 Soprano Sax		64
	66 Alto Sax		65
	67 Tenor Sax		66
	68 Baritone Sax		67
	69 Oboe		68
	70 English Horn		69
	71 Bassoon		70
	72 Clarinet		71
Pipes: 	73 Piccolo		72
	74 Flute		73
	75 Recorder		74
	76 Pan Flute		75
	77 Blown Bottle		76
	78 Shakuhachi		77
	79 Whistle		78
	80 Ocarina		79
Synth Leads: 	81 Lead 1 (square)		80
	82 Lead 2 (sawtooth)		81
	83 Lead 3 (calliope)		82
	84 Lead 4 (chiff)		83
	85 Lead 5 (charang)		84
	86 Lead 6 (voice)		85
	87 Lead 7 (fifths)		86
	88 Lead 8 (bass + lead)		87
Synth Pads: 	89 Pad 1 (new age)		88
	90 Pad 2 (warm)		89
	91 Pad 3 (polysynth)		90
	92 Pad 4 (choir)		91
	93 Pad 5 (bowed)		92
	94 Pad 6 (metallic)		93
	95 Pad 7 (halo)		94
	96 Pad 8 (sweep)		95
Synth Effects: 	97 FX 1 (rain)		96
	98 FX 2 (soundtrack)		97
	99 FX 3 (crystal)		98
	100 FX 4 (atmosphere)		99
	101 FX 5 (brightness)		100
	102 FX 6 (goblins)		101
	103 FX 7 (echoes)		102
	104 FX 8 (sci-fi)		103
Ethnic: 	105 Sitar		104
	106 Banjo		105
	107 Shamisen		106
	108 Koto		107
	109 Kalimba		108
	110 Bag pipe		109
	111 Fiddle		110
	112 Shanai		111
Percussive: 	113 Tinkle Bell		112
	114 Agogo		113
	115 Steel Drums		114
	116 Woodblock		115
	117 Taiko Drum		116
	118 Melodic Tom		117
	119 Synth Drum		118
Sound Effects: 	120 Reverse Cymbal		119
	121 Guitar Fret Noise		120
	122 Breath Noise		121
	123 Seashore		122
	124 Bird Tweet		123
	125 Telephone Ring		124
	126 Helicopter		125
	127 Applause		126
	128 Gunshot		127

1.3.5.4 The "LED Stage"

With no art object placed on it (“bare”), the “LED Stage” will look something like this:



The LED Stage is designed with a purpose and also with some fun in mind:

1. Using color scheme, to give a general indication of body position within the Sonar’s height range (as set with the SONAR control); and
2. To provide some animated colorful effects on art pieces, just for fun.

The LED Stage can be used to your own personal liking with various kinds of interesting objects placed over it. The LED Stage colors indicate sonar sensing of height level.

You can put a real quartz crystal on it. The LED Stage color scheme changes with your body height moving over the SpaceHarp controller; generally, the reddest color scheme indicates the “highest” in the currently setup Sonar range.

(Sonar height = higher)

(Sonar Height = lower)

You can use the “plastic gem disk” that we supply.

The LED Stage can also be visually “muted” or “blacked-out” when desired, by turning the left-most LED BRIGHT knob at the front of the controller all the way left, i.e. all the way counterclockwise. This control has no effect on MIDI messages out, or on Sonar sensing.

1.4 STANDARD ACCESSORIES

1.4.1 Overview of Standard Accessories

The SpaceHarp MIDI controller works with a small Sensor Light. This setup is what creates the amazing advantages of a high-precision cone of "virtual strings" for triggering music and visual events. The Sensor Light also creates the very useful (and adjustable) Player Reference Shadow. The Sensor Light can be mounted in a number of ways, such as on a standard microphone stand with additional gooseneck, on an adjustable mic boom, or on a professional C-Stand. In some performance stage situations it's overhead truss- or pipe-mounted above a player's stage position.

Our recommended multi-purpose solution is a sleek and fully adjustable stand for the SpaceHarp that also has an attached boom and gooseneck for the Sensor Light above. This standard Stand and Light Sub-Assembly also provides handy places to mount optional touch control tablet(s) as well.

The SpaceHarp Pedalboard provides an economical set of foot switches and pedals that together fully exploit the SpaceHarp's built-in ¼" jacks. The SpaceHarp converts these devices' signals into the MIDI message stream which the SpaceHarp transmits. Functions for these are described in the external document, **Sound Galaxy 2.0 Users Guide**.

The SpaceHarp Controller, Sensor Light, Stand and Pedalboard together provide the full controller hardware system, ready to connect by MIDI to whatever laptop, rack-based system or other digital audio workstation (DAW) setup that is to be used.

Section #	Sub-Assembly
1.4.2	Stand and Light Sub-Assembly
1.9.2	SpaceHarp MIDI Controller
1.4.4	SpaceHarp Pedalboard Sub-Assembly

For the full features and functions of SpaceHarp as presented in this User Guide, and in the **Sound Galaxy 2.0 User Guide,** we recommend the equipment items described. We certify issue-free operation with those products. There are also many equivalent devices that can alternatively be used, and those are sometimes mentioned in the User Guides.

A comprehensive list of all parts, for Sub-Assemblies as well as for full hardware systems, may be found in the Table of All Devices and Parts.

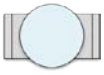
See the external document SpaceHarp Performance Systems for details on full turn-key systems, ranging from laptop to 4U and 6U 19" rack-mounted solutions.

1.4.1.1 Key to Symbols Used for Parts and Devices Numbering

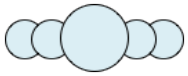
For added clarity, our numbered callouts for devices and parts use these three types of symbols:

1.4.1.1.1 External Device Not mounted in Rack

1.4.1.1.2 Rack-Mounted Device



1.4.1.1.3 Sub-Assembly (comprised of External and/or Rack-Mounted Device



1.4.2 Stand, Boom and Light Sub-Assembly

1.4.2.1 Stand

1 Ultimate Apex-48 Stand is recommended, and supplied in standard sub-assemblies and systems.

1.4.2.2 Stand Soft Case

2 Ultimate Apex Stand soft case is recommended, and supplied in turn-key bundled systems.

1.4.2.3 Short Stand Arms

3 Two TBR-130 13” Tribar Arms for optional uses for laptop or remote tablet mounting.

1.4.2.4 Long Stand Arms for SpaceHarp

4 Two TBR-180 18” Tribar Arms with custom tabs added for SpaceHarp controller are provided in turn-key bundled systems.

1.4.2.5 Stand to Arms Brackets

5 Two CMP-485 Super Clamp brackets.

1.4.2.6 Stand to Mic Boom Adapter

6 AX-48 Pro Threaded Adapter plate.

1.4.2.7 Mic Boom

7 MC-40B Pro Boom Mic Boom.

1.4.2.8 Stand Cable Clips

8 Ultimate cable clips (pre-installed.)

1.4.2.9 Quick-Lock Mic Boom Adapter

9 Quick-lock mic adapter (pre-installed.)

1.4.2.10 Sensor Light

10 Mini-PAR-16 light with halogen bulb, with AC power cable cable-tied, and boom extended and locked. (mini-PAR fits on either Stand model). See **Section**____ for details.

1.4.2.11 Mic Boom Soft Carry Case

11 Pre-assembled Pro Mic Boom’s soft carry case.

1.4.2.12 Foam Mounting Wedge

12 One SpaceHarp Foam Mounting Wedge with Velcro.

1.4.2.13 Theatrical Sandbags (optional)

13 15-25 lb. sandbag(s) for APEX mount rear, recommended for added safety and stability; Also useful for other stands such as Universal Speaker, Laptop Mic-Stand, C-Stand, etc.

1.4.2.14 Sensor Light Boom Assembly

14 Comprised of the Mic Boom 7, Quick-Adapter 9, and PAR-16 Light 10.

1.4.2.15 Theatrical Gels

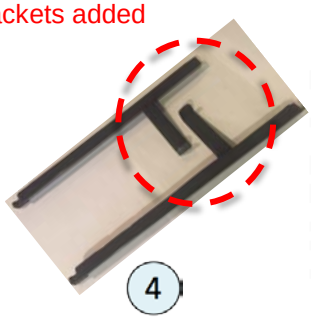
15 Set of Gels for PAR-16 Light gel holder. See **Section**___ for details.

1.4.2.16 Stand and Light Parts

18" Tribars with Custom L-Brackets added

Apex® AX-48 Pro Plus

TBR-130 13" Tribar Arm Pair



TBR-180 18" Tribar Arms Pair

CMP-485 Super Clamp

Apex® AX-48 Pro (Black)

AX-48 Pro Tote

AX-48 Pro Threaded

AX-48 Pro Mic Boom with Adapter

Cable Clips

Quick-Lock Mic Adapter

mini PAR-16 & Gels

Soft Carry Case

Foam Wedge

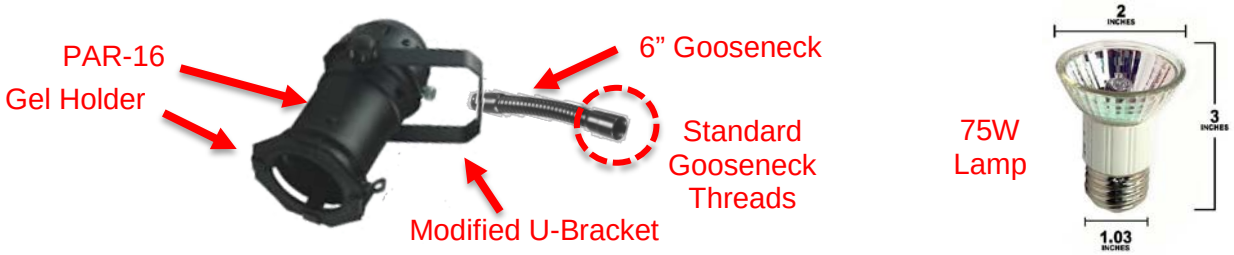
20-lb Theatrical Sandbag

Sensor Light, Mic Boom Assembly

1.4.3 Sensor Illuminator Light

1.4.3.1 Mini-PAR-16 Fixture

10 The Sensor Light for our Limited Edition model SpaceHarp, that we provide with each SpaceHarp, is a mini-PAR-16. This PAR is small, it's only 3" x 3" x 6". Every SpaceHarp comes with this mini-PAR with a modified U-bracket having an attached 6" flexible gooseneck. The standard gooseneck threads can be in turn attached to various choices of mic stands, booms or mounts. For a theatrical flown or hung Light, simply remove the gooseneck and use the U-bracket with a clamp.



1.4.3.2 Halogen Bulb

The PAR-16 is used with an inexpensive 75W Halogen wide-angle bulb for use with high-temperature ceramic screw base which these PARs have. Always keep one or more spare halogen bulbs on hand in case one burns out or is otherwise damaged.

Replacements for both housing and bulbs are commonly available through pro lighting and sound dealers as well as online. For example, the USHIO 75w 120v MR16 E26 medium base FL30 halogen bulb; https://www.bulbamerica.com/products/ushio-75w-120v-mr16-e26-medium-base-fl30-halogen-bulb.

Every SpaceHarp comes with one bulb inside the provided mini-PAR plus two additional spare bulbs. Note the excellent life of 2,000 hours.

The specifications for these bulbs are as follows:

Base	E26 Medium Screw
Beam Angle (deg.)	30
Beam Spread	Narrow Flood NFL
Bulb Type	Halogen Bulbs
Color Temperature (K)	3000K
Maximum Overall Length (in)	3.00
Rated Life (Hours)	2000
Shape	MR16
Voltage (V)	120V
Wattage (W)	75W

IMPORTANT NOTE: If you don't have a working halogen bulb for the PAR-16, you may have NO SPACEHARP FUNCTIONS. SpaceHarp can sometimes work with non-fluorescent, directional task lighting, or even with direct sunlight, but there is no guarantee that those light sources will work in any particular situation.

1.4.3.3 Gels for Sensor Light

(15) We also provide a 30% and a 60% neutral density filter plus deep blue and purple gels for the mini-PARs gel holder. The gels have little to no effect on sensing, but do tone down the brightness of the visible shadow to be just light enough to see. Available from your local theatrical lighting supplier, or online.

See for example http://www.guitarcenter.com/American-DJ/Gels-Gobos-Lenses.gc

1.4.3.3.1 30% ND Gel

(15a) Available from theatrical lighting and supply vendors.

1.4.3.3.2 60% ND Gel

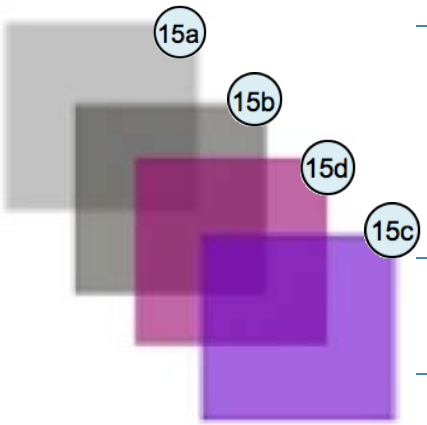
(15b) Available from theatrical lighting and supply vendors.

1.4.3.3.3 Deep Blue Gel

(15c) Available from theatrical lighting and supply vendors.

1.4.3.3.4 Deep Purple Gel

(15d) Available from theatrical lighting and supply vendors.



WARNING: If the dark blue or purple gel gets worn-through (it will after a few dozen hours), replace it with a new one. MAKE SURE LAMP IS TOTALLY COLD FIRST else you could get a burn. You'll notice that as the gel wears, the light increases more.

WARNING: DO NOT TOUCH the overhead Halogen sensor illuminator light PAR-16 housing when the lamp is turned ON. If you are changing gels, or changing bulbs, please turn OFF the light, first! *THE LIGHT CAN GET HOT! DON'T GET BURNED!*

WARNING: DO NOT loosen the overhead light stand knob at its base, or move the light stand, in a way that allows it to fall onto the SpaceHarp which could *cause serious damage to the controller.*

When you setup, always make sure that any threads and knobs for your light mounting are completely tight, BEFORE you place the SpaceHarp underneath it; likewise, when you tear down, remove the controller FIRST, then the light stand.

If you must position the light when it is ON and OVER the controller, then have someone help you by holding any stand with you, to prevent it from falling down. Hold the light by the STAND, NOT by the PAR-16 housing, to prevent a burn injury.

WARNING: DO NOT cover over the SpaceHarp, stand and light setup with such as theatrical blackout cloth or other cover, until you know the illuminator light is OFF and is also completely COLD. *Otherwise, there could be a fire hazard!*

For details of initial setup of Stand and Sensor Light, see Setup Full System.
For Adjusting Stand for Player Height when ready to play SpaceHarp, see Adjust Stand for Player Height.

1.4.4 Pedal Board Sub-Assembly

16 The functions of 'sustain', 'global octave shift up and down', 'all notes off' 'Mod', plus 'user assignable pedals,' encourages players to "stay in space" by minimizing hand use for common controls.

SpaceHarp pre-assembled Pedal Board is comprised of pedals, pedal board, cables and re-configurable assembly using heavy duty Velcro. For an economical but sufficient setup, these popular products are used.

1.4.4.1 Pedal Board with Heavy-Duty Velcro Mountings

16a Gator T-Bone is suggested, and (1) is bundled with SpaceHarp Pedal Board Sub-Assembly. All six of the Pedal Board's devices are firmly attached to the Board with super-heavy-duty Velcro, however they still can be repositioned if desired.

1.4.4.2 Sustain Pedal

16b M-Audio SP-2 is suggested, and (1) is bundled with SpaceHarp Pedal Board Sub-Assembly.

1.4.4.3 Expression Pedal

16c M-Audio EX-P is suggested, and (2) are bundled with SpaceHarp Pedal Board Sub-Assembly.

1.4.4.4 Momentary Switches

16d Boss FS-5U are suggested, and (3) are bundled with SpaceHarp Pedal Board Sub-Assembly.

1.4.4.5 Attached Color-Coded ¼" Cables with Cable-Wrap

C10 For SpaceHarp Pedal Board Sub-Assembly, appropriate cables are color-coded and wrapped. Cables are 6-ft. length and are color-coded, black cable-wrapped together, and ready to connect to the SpaceHarp Controller.

1.4.4.6 Soft Carry Bag for Pedal Board

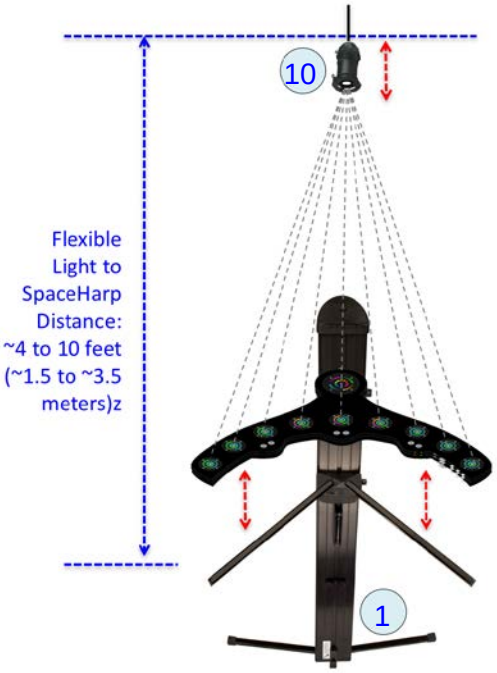
17 Gator T-Bone carry case for Pedal Board & Cables Assembly

1.5 SETUP CONTROLLER & ACCESSORIES

1.5.1 Stand and Light Sub-Assembly

1.5.1.1 Mounting of PAR-16 Sensor Illuminator Light

The provided Sensor Illuminator Light should be at least 1.5 meters (4 feet) from the controller surface. About 5 feet is probably ideal, and up to 10 feet will work as well.

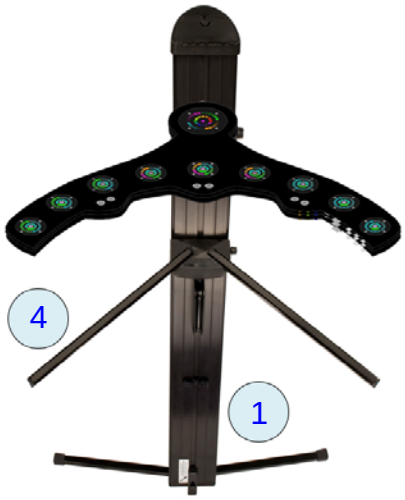


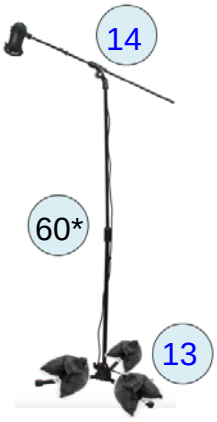
The sensor Illuminator light can be mounted over the SpaceHarp controller in at least four alternative ways (see the illustration below):

- Attached at end of the mic boom that attaches directly to the Ultimate APEX Stand. See the next Section.
- Mounted on a mic boom and/or gooseneck, attached to a tall microphone stand
- Mounted on a Professional C-Stand, which can extend further horizontally therefor giving an unobstructed performance space on stage.
- Hung from an overhead truss, ceiling or other high-up support.

It's a good idea to try and tilt the SpaceHarp forward, while keeping the line of sight from the controller surface to the Light about 90-degrees (in other words, directly "square" above the controller. This is the nicest 'feel' where note triggers and sonar height sensor most ideally overlap.

APEX Ultimate Stand
With Pro Mic Boom
(typical LBE or Stage)





Mic Stand With
Pro Mic Boom
(alternate for use with
X-Keyboard Stand
Or Table-Top)
-or-
Professional C-Stand 61*

*Mic Stand (60) & C-Stand (61): See User Guide for Interactive Performance Systems

1.5.1.2 Setup the Apex-48 Stand for SpaceHarp Use

Here we detail instructions for setup of an “ideal” and the preferred physical setup for the SpaceHarp LE Controller.

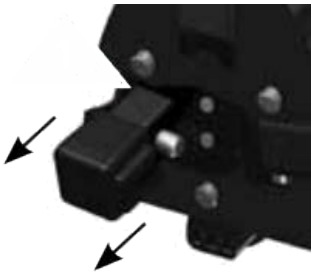
The instructions here for the recommended Ultimate Apex-48 Stand are essentially identical to that for the alternative, the Ultimate Deltex DX-48B Pro stand. The Deltex has identical features, except it has a thinner profile and without having an inside cavity for storing the stand legs inside of it. It’s also lighter weight.

STEP (1) Remove the APEX-48 Pro Ultimate Stand (1) from its tote case (2) or other carry case (if any.)

STEP (2) Remove the customized SpaceHarp 18” Tribar arms (4) from the small side pocket on the tote case (2) or other carry case.

STEP (3) Lay stand (1) on the floor.

STEP (4) Press the buttons at the base of the stand column and slide the three floor legs out.



STEP (5) Rotate the legs until they snap into place.

STEP (6) Stand AX-48 Pro Stand (1) upright on a flat, solid and smooth surface. Do not use on sand, or loose earth material, as it could tip over; use a small plywood or other platform under it.

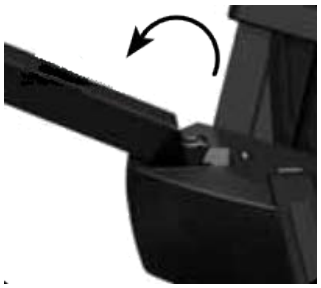
Super Clamps (5) will already be installed on the stand. (There’s room in the case for them.)

The upper Super Clamp (5) can be optionally used for mounting a remote controls tablet or a laptop using the 13” Tribars (3).

The lower Super Clamp (5) is used for the SpaceHarp.

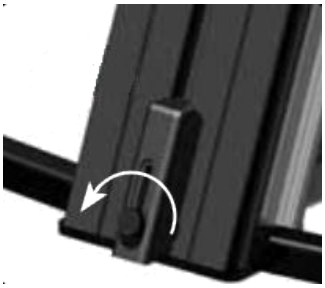
STEP (7) If not already installed, slide and tighten the upper Super Clamp (5) to be about 7” from the top of the stand (1) mounting slot. Mount the lower Super Clamp (5) for the SpaceHarp about 16” from the top of the stand (1) mounting slot (leaving about 9-10” between the tops of the upper and lower Super Clamps (5).

STEP (8) Attach the SpaceHarp-modified 18" Tribars (4) to the lower Super Clamp (5). Gently push Tribars (4) down into slots in the top of the lower Super Clamp (5).



STEP (9) Attached the provided Foam Mounting Wedge (12) to the Velcro supplied on the top of the lower Super Clamp (5). The Mounting Wedge provides an ideal angle for the SpaceHarp controller for most players, however its use is optional.

STEP (10) Loosen thumbscrew at bottom of the stand (1) and slide the stabilizer down to touch the floor. Re-tighten the Thumbscrew.



The stabilizer bar generally prevents the stand from tipping forward. However, if the Mic Boom and Light Assembly is tilted far forward, the center of gravity shifts forward.

STEP (11) In this case we recommend using a small 15- or 20-lb sandbag (13) on the stand's rear floor leg as an added safety precaution. See the following Section's illustration below.

1.5.1.3 Attach Mic Boom Assembly

STEP (1) Remove the Pre-Assembled Pro Mic boom, Sensor Illuminator Light (mini-PAR-16) and snap-on mic adapter (14) from its soft carry case (11). Be careful not to drop or otherwise jar the Light, to avoid damaging or breaking the halogen lamp in the mini-PAR-16 fixture (10).

STEP (2) If not already installed, slide the one or more gels into the mini-PAR (10) gel holder. When an in-line AC dimmer is installed you can optionally use no gel and instead turn the brightness lower; you'll have the sharpest visible shadow in this mode.

STEP (3) Note that the Apex Stand in a SpaceHarp pre-configured system will already have the Pro Mic Boom stand's Adapter Plate (6) pre-installed, and also an added quick-lock mic stand adapter (9) on it. Likewise, the Pro Mic Boom has the mating snap-on adapter (9) already on it as well. This allows a quick attachment of the Pro Mic Boom and Light to the Apex Stand - without turning the boom and light assembly around and around on threads; (which otherwise isn't at all easy with the Sensor Light attached.)

STEP (4) Note that in a SpaceHarp pre-configured system, the Pro Mic Boom Assembly (14) will be fully extended and locked, which will be about 24" in total length, and the Sensor Light will be attached at top with a 6" gooseneck. The AC power cable from the mini PAR-16 will be cable-tied down to the bottom of the boom.

STEP (5) Thread the Sensor Light AC power cable through any stand cable clips or zip-ties down to the base of the Apex stand.

STEP (6) Connect an in-line, AC dimmer cable or switch onto the end of the Light's AC cable. Do not plug in AC until after you have completed the below additional setup steps.

STEP (7) Using its base, tilt the mic boom & Light Assembly to about 40-45 degrees from vertical (90 degrees), and firmly tighten it. This should put the Light about 42" from the stop of the SpaceHarp Controller after it has been placed onto the Stand. This is about the minimal distance.

STEP (8) If you want a greater distance, then either add additional goosenecks onto the end of the Mic Boom Stand, extend the boom if it was not already, and/or, lower the bottom Super Clamp so the SpaceHarp controller will be slightly lower down.

STEP (9) Angle the mini-PAR aimed directly downwards at the controller, and tighten its U-bracket thumbscrews firmly. Do not use a wrench or pliers, but tighten firmly by-hand only. See Re-Adjusting the Stand and Sensor Light.

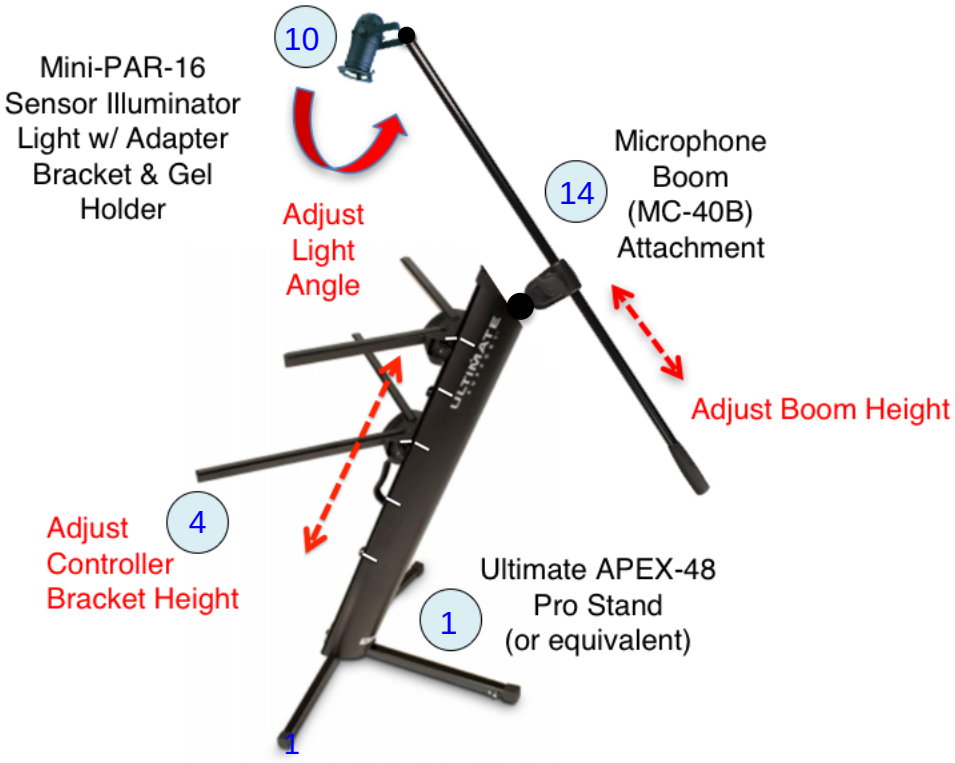
1.5.1.4 Adjust the Stand for the Sensor Illuminator Light ✓☐

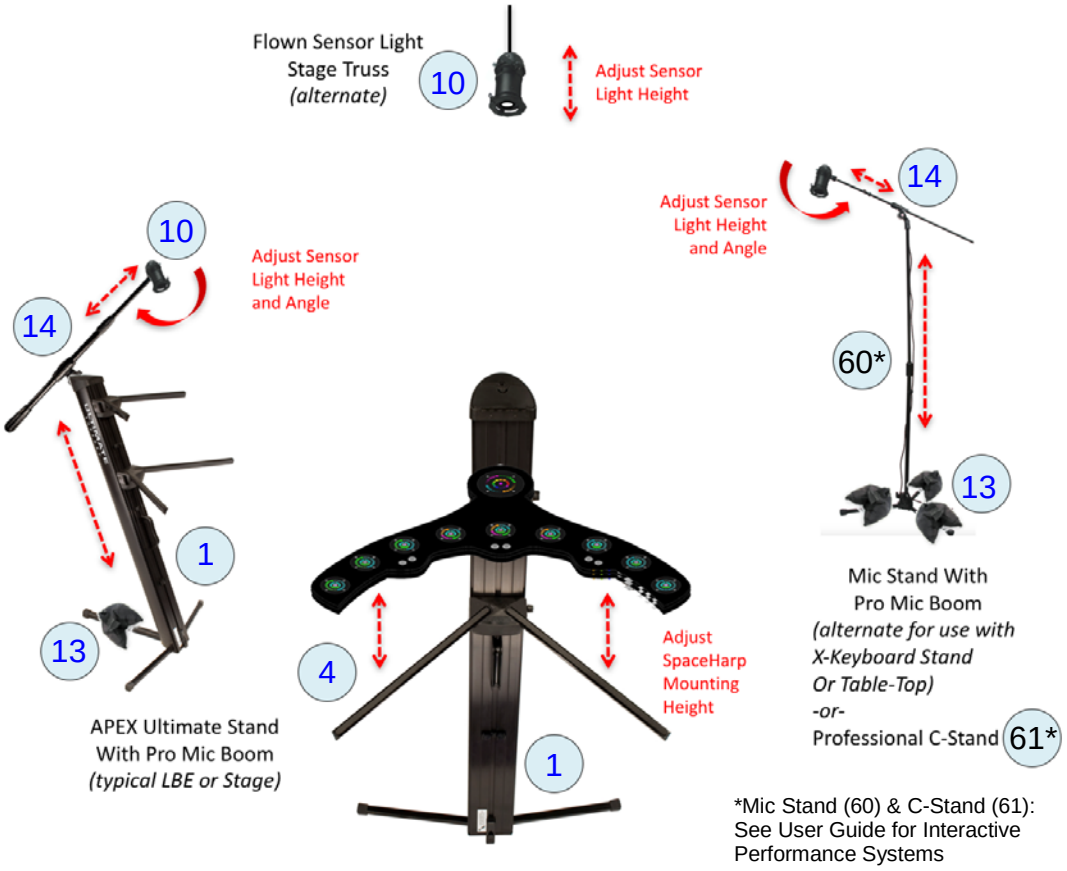
STEP (1) Raise or lower any combination of the Sensor Light (however it is mounted) and the Stands **Customized Tri-Bar** bracket height

STEP (2) Adjust the overhead Sensor Illuminator Light so that it aims directly at the center of the SpaceHarp Controller at a minimum of 1.5 meters distance. It only has to be approximate. You'll know you've got it right when:

- With Light on, no Trigger LEDs (the nine inner/lower LEDs) are lit up; and
- With Light on, Trigger LEDS light up when you move over (shadow) their sensors.

WARNING: For walk-up public players, usually only the event "Host" makes these adjustments and does so only when absolutely necessary. And for Pro performers, please also be very careful, even though you're familiar with this type of equipment.





*Mic Stand (60) & C-Stand (61): See User Guide for Interactive Performance Systems

1.5.2 Place the SpaceHarp Controller on the Stand Assembly

1.5.2.1 Mount the SpaceHarp and attach Power Supply

STEP (1) Carefully remove the SpaceHarp controller from its case.

STEP (2) Place the SpaceHarp on the customized Tribars (4), which puts their L-shaped tips just inside the left-most and right-most sonar sensors. Do it gently, no force should be required; it's made to fit.

STEP (3) Rest the Controller Top (where the three concentric rings of Stage LEDs are) onto the Mounting Foam Wedge (12), letting the provided Velcro hold it into place.

STEP (4) Unpack the SpaceHarp's Power Adapter, and thread it's DC cable up through the stand clips and/or zip-ties, and plug it into the SpaceHarp's 5V DC 10A Power jack.

CAUTION AND WARNING: *USE ONLY THE CORRECT AC-to-DC POWER ADAPTER!*

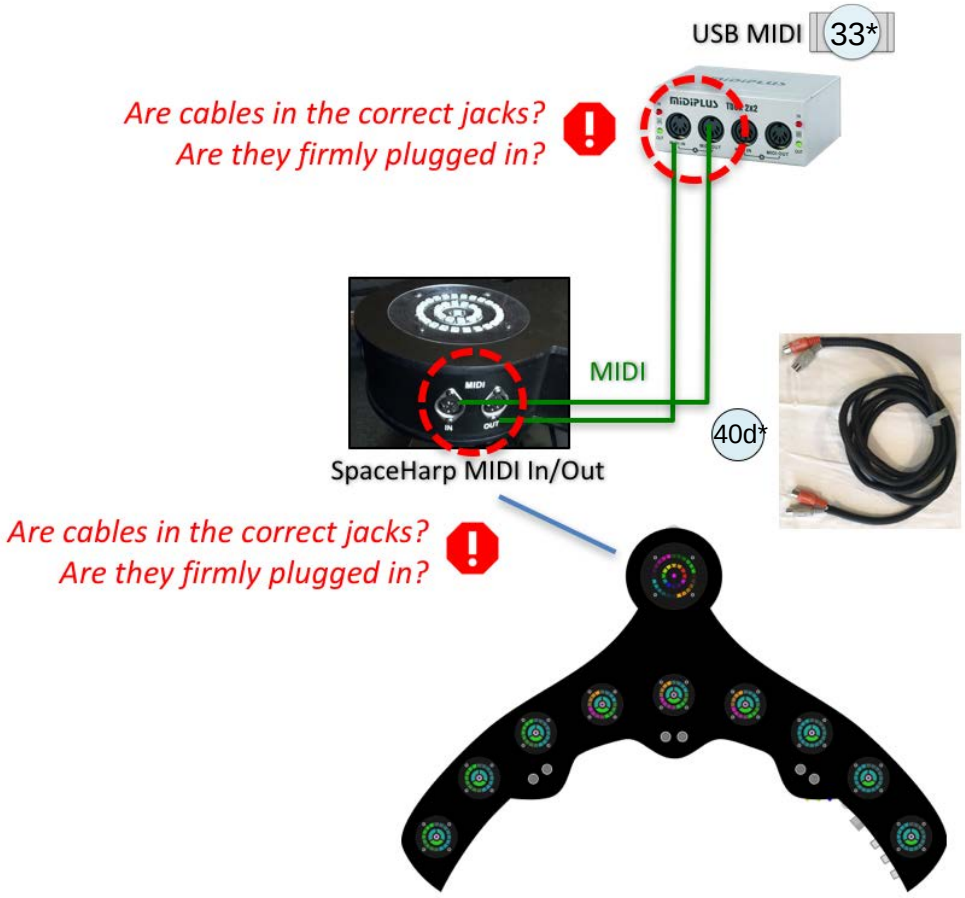
If you must use a replacement, make sure it is the correct DC 5V 10A switching power supply with a 2.1mm DC plug having positive "+" tip.

If you do NOT use the correct Power Adapter, you could possibly severely damage the SpaceHarp and require a hardware repair. Or, this could also even cause a fire.

STEP (5) If you are going to be using the recommended SpaceHarp Pedal Board Assembly, do NOT power-on the SpaceHarp until AFTER all of its ¼" cables have been installed into the SpaceHarp. Instructions for the Pedal Board Setup are included in the following Section.

1.5.2.2 Connect SpaceHarp MIDI

STEP (6) Connect a standard, 5-pin DIN serial dual-MIDI cable to the MIDI IN/OUT ports of the SpaceHarp controller. The MIDI cable from SpaceHarp's MIDI OUT connection goes to the DAW systems' MIDI IN port; this cable has red-colored MIDI plugs, (or red-colored tape on those plugs). *Be sure to always connect a MIDI OUT to a MIDI IN; never connect MIDI IN-to-IN or MIDI OUT-to-OUT, as that can damage the equipment.*

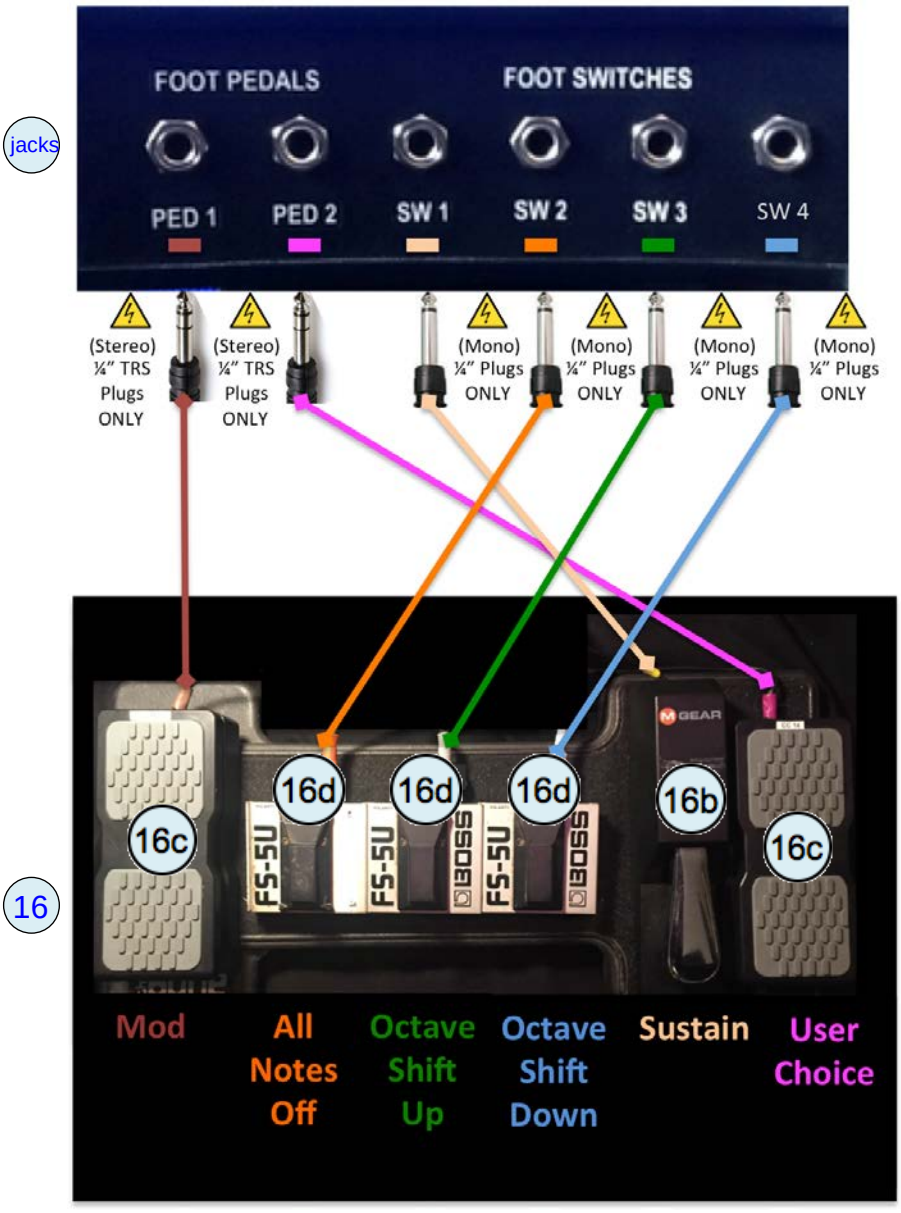


STEP (7) Thread the dual-MIDI cable (15) through the clips on the stand, or through zip-ties, to neaten it. If your DAW system isn't setup yet, leave the unattached MIDI cable set aside until later.

1.5.3 Setup the Pedal Board

1.5.3.1 Pedal Board to SpaceHarp Connections

STEP (1) Connect the ¼" cables for up to four foot switches and up to two continuous controller pedals into the appropriate jacks on the SpaceHarp. Use the color-coding to help you. The below figure shows the cable connections without being hidden by the included cablewrap.



WARNING: Always plug the foot pedal cables into (or remove them from) the SpaceHarp while the controller is completely POWERED OFF. This is a safety precaution to eliminate any possible chance of damaging the controller.

WARNING: Always plug the foot pedal cables into the correct type of ¼" jack. DO NOT plug pedals into switch jacks or vica-versa. This is a safety precaution to eliminate any possible chance of damaging the controller. These cables are color-coded with matching color tabs on the controller, to prevent this, as well as to ensure the right MIDI is associated with the arrangement of the pedals on the pedal board. *Use the color-coding!*

1.5.3.2 Connecting the Pedal Board

The physical system cable **C10** is wrapped and is permanently connected to three pedals on the Pedal Board (the two m-Audio expression pedals and the M Gear Sustain Pedal. The three BOSS momentary switches on the Pedal Board are connected with mono (unbalanced) ¼" cables. Make sure they are firmly in place. Note the color-coding when you make these connections. Always connect these cables into the SpaceHarp while the SpaceHarp controller power is switched OFF.

1.6 STARTUP SPACEHARP

Here we illustrate in more detail the steps and considerations for going from cold power up to Playing SpaceHarp, using a hardware system that has already been setup and cabled. This may be after transport and previous setup, or, after a system that was previously operating, has been completely powered down (all devices and AC power turned "OFF.")

1.6.1 Prepare to Turn On

STEP (1) If you're adding a Pedal Board this session, remember to connect any foot switches or pedals before you turn on the SpaceHarp. Make sure their cables are correctly plugged in: see *Connecting the Pedal Board* for the default recommended foot pedal and switch connections setup.

STEP (2) Turn on (or plug in) the overhead Sensor Illuminator Light. It maybe unplugged or turned-off for safety. Slide its in-line AC dimmer (if present) to maximum brightness, initially.

STEP (3) Set the front hardware control knobs on the SpaceHarp to the below "best practice" positions. At first, they should be set to the angle of the red markings in the below illustrations. The Channel knob is set to the "2 o'clock" position for a 1-SpaceHarp setup. The three knobs at right, can all start out set to their respective "10 o-clock" positions.

IMPORTANT NOTE: Initially set all knobs on the SpaceHarp to the above "best practice" marked positions. You can adjust these later if desired. Note that the CHANNEL select knob requires a RESET to apply any new setting. However, the LED BRIGHT and SONAR knobs do NOT need a RESET since they change immediately.

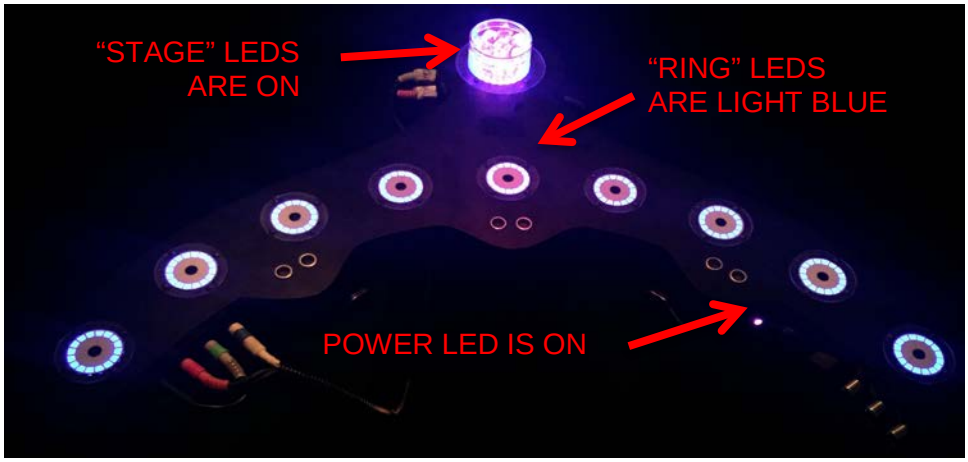
STEP (4) Turn ON the SpaceHarp using the rocker switch at its rear.

If the SpaceHarp doesn't appear to turn on, see ***Troubleshooting: Turning On the Controller.***

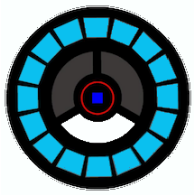
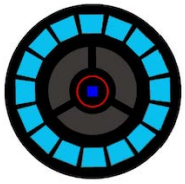
1.6.2 Power-Up and Confirm Status

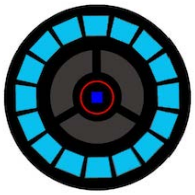
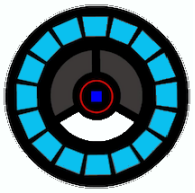
STEP (1) Once it has turned on, step back while the SpaceHarp calibrates its sensor arrays. Don't move over it while it boots up.

After the power-up LEDs animation stops, all the "ring" LEDs should be lit in a nice blue color. Some of the inner LEDs may be lit, but just ignore them for now.



STEP (2) Go ahead and make some initial sweeping motions with your arms over all nine of the sensors on the controller. You should see white LEDs light up whenever you move over the sensors, and you should see the white color go dark when your shadow moves away from them.

When shadowing sensors, you should see this:  not this: 

When NOT shadowing sensors, you should see this:  not this: 

STEP (3) Now move away and stop shadowing. If ANY of the inner/lower "trigger" LEDs remain ON (lit up) - even with the overhead light dimmer set to maximum and while you are NOT shadowing any of the sensors - then you need to adjust the overhead light's positioning. See ***Re-Adjust the Sensor Light***.

1.6.3 Reset the Controller

STEP (1) Press the SpaceHarp's RESET button at front right if SpaceHarp was already powered ON.

STEP (2) Step back while it calibrates to the overhead light now being ON.

TIP: Turning the rocker Main Power switch ON, or, pressing RESET (either on the controller front or at controller rear), all identically run the SpaceHarp through its ambient light calibrations (each sensor, separately) and with an associated "Startup LED Animation."

STEP (3) Test the Trigger (Shadow) Sensors. You should be able to move over the SpaceHarp making shadows, and you'll see the inner lower LEDs (only) change (defaulting at white; or however the last color was set.) No Computer is needed to verify the SpaceHarp triggering, just the light.

See Troubleshooting if when you move over the SpaceHarp, LEDs don't change.

STEP (4) If you want another "trigger" LED color (it defaults to white), and also to choose the quantized LED color (it defaults to light blue), then open the MIX tab on your remote control device (or on the laptop if you're not using a remote), and move the two color faders located over the Inner LEDs color indicator graphic. See **Using the Mix Tab Section** of the **Sound Galaxy 2.0 User Guide.** Then when moving over SpaceHarp's nine shadow motion sensors you'll see the new trigger LEDs color. (When you launch a track and PLAY you'll then also see the quantized LED's chosen color.)

TIP: If you'd prefer to turn "off" any inner/upper LEDs remaining lit "on" after the power-up LED animation, then gently turn the right-hand "LEDs" knob counterclockwise to "off," then turn it slowly back clockwise to where you started. Now you'll see all inner LEDs are dark as they should be. Don't turn it clockwise beyond the LED BRIGHT position nominally set in "best practice" – about at '10 o'clock.' (You only ever have to do that "clear" ONCE after you initially power-ON or RESET). It's okay to ignore this step if you don't care, since those LEDs will also clear to dark (initially) from any SONG START.

TIP If you want darkest possible Sensor Illuminator light, know that it's possible by using gels to get the light so faint you can barely see your shadow, and yet it still works fine. First, with the light turned OFF and COOL to the touch, add a dark gel to the mini par if it's missing or bone clear. Go back to **STEP (3)** above.

EXTREME CAUTION AND WARNING: Do Not turn the LED Brightness Knobs all the way to the right (full brightness) and leave them set at that level for more than several seconds. This can possibly damage the LED boards. *This is an alpha-prototype LE controller issue only.* We have marked "**LED MAX"** (i.e. maximum safe LED brightness) clearly on the prototype units. Don't exceed it.

NEVER DO THIS:

NEVER TURN LED BRIGHTNESS TO 100% AND LEAVE IT THERE*

(prototype LE units only.)

1.6.4 Adjust Stand for Player Height

In any setup, the basic idea here is to adjust the SpaceHarp height so it's at a comfortable position for the player. In the bundled SpaceHarp Kiosk System, the provided stand is an Ultimate Support model Apex AX-48 Pro or Deltex DX-48B Pro, plus two included customized support arms for SpaceHarp.

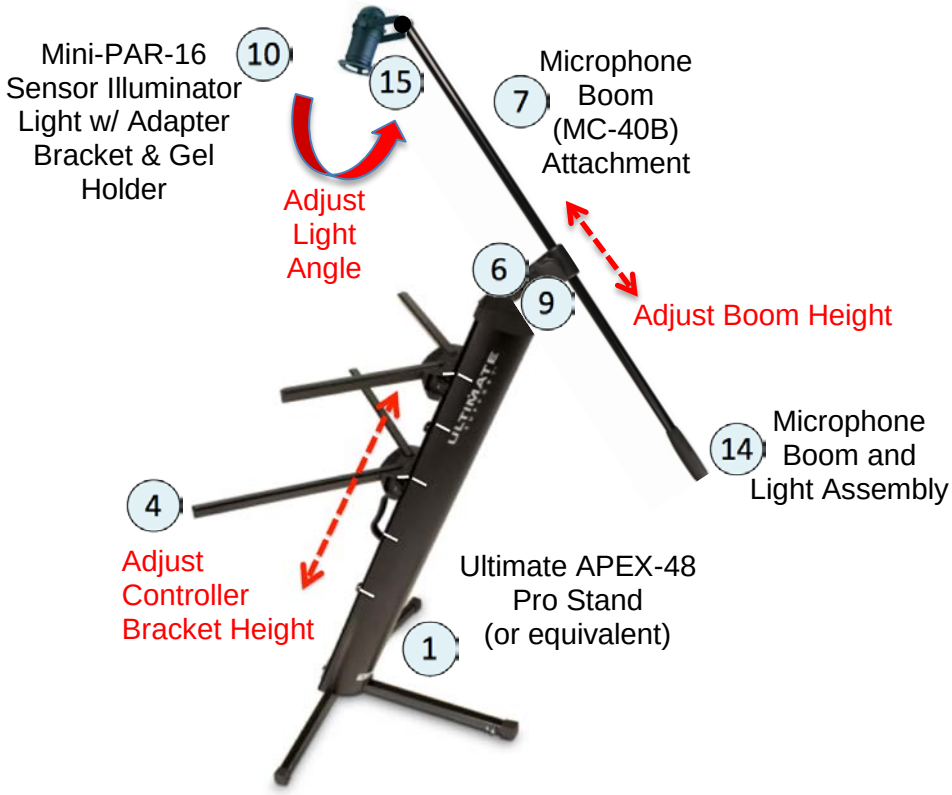
Together these provide a perfect way to mount and adjust the height of the controller. If the player is under 4 feet or over 6 feet tall, then adjusting the SpaceHarp's mounting height can be a good idea.

It's usually not necessary to do this, but it's ideal for maximum player ease-of-use. Fortunately, this is easy to do with the Apex Ultimate Stand.

STEP (1) Carefully unlock and slide the SpaceHarp mounting arms assembly up or down on the Stand.

STEP (2) Be careful not to knock the SpaceHarp off its mount. This will take a little practice. For maximum precaution, you can remove the SpaceHarp from the Stand, and put it back on after adjusting the Stand.

TIP: We illustrate below how you can if desired tape-mark this type of stand with white reference tapelines. Five tape marks in this example would correspond to your preferences for 3 ft., 4 ft., 5ft., 6 ft. and 7 ft. tall players, respectively. Align the top edge of the sliding mount (also marked with white tape) to the white marks on the stand for the corresponding player height, to avoid any guesswork when adjusting the stand for different players

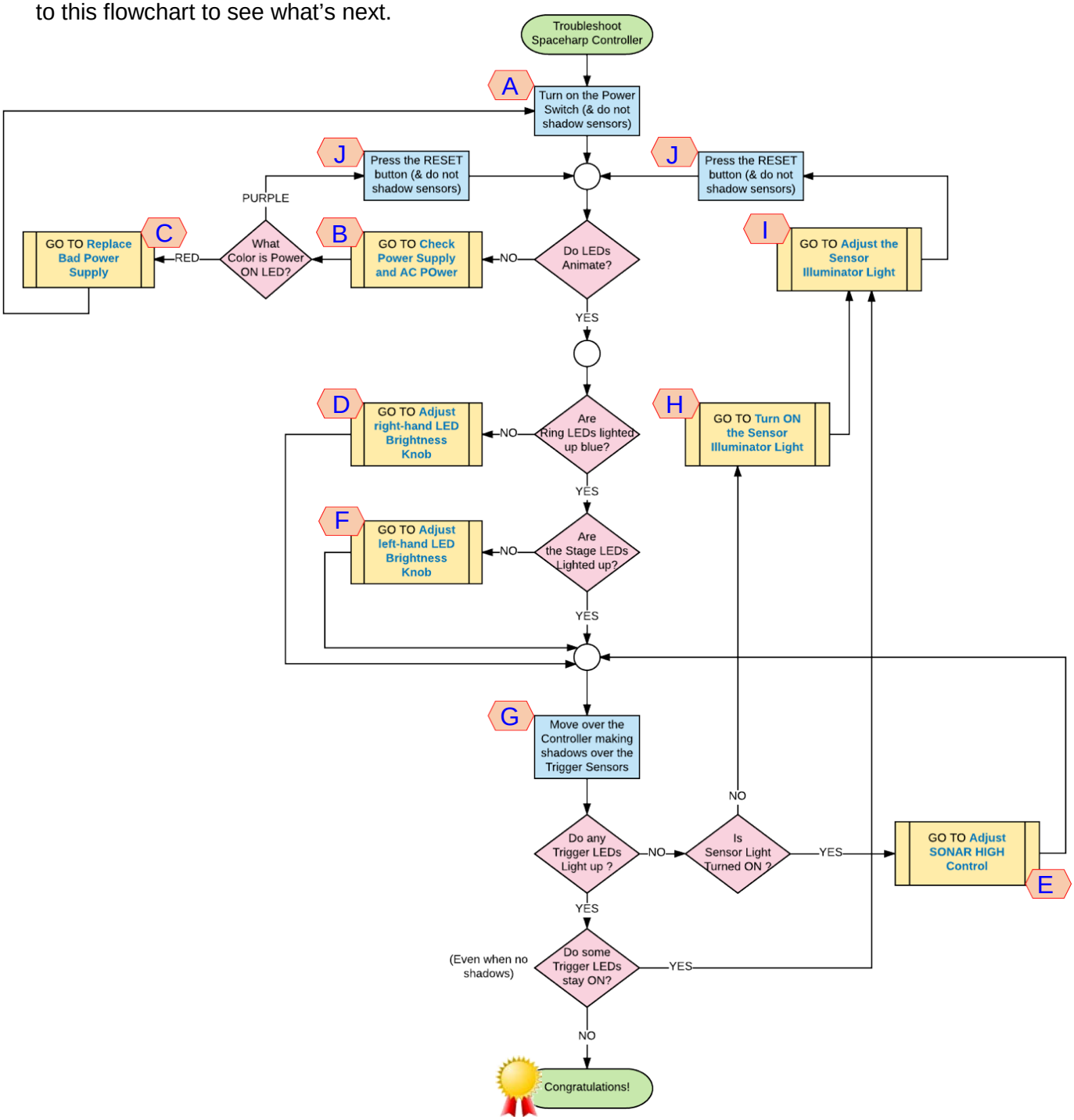


1.7 TROUBLESHOOT

We include these issues mainly for completeness of this Guide. These problems will rarely if ever arise, and when they do, 95% of the time it's an issue such as forgetting to turn ON the Sensor Overhead Light, having one or more disconnected or wrongly connected cables, and/or finding that knobs on the SpaceHarp Controller have gotten bumped unintentionally.

1.7.1 SpaceHarp Controller Troubleshooting Flowchart

To assist you in a quick recovery from any issue with the SpaceHarp Controller, we include this handy flowchart to determine which recovery procedure(s) to use. If you're on an electronic Guide, click on a recovery steps letter label and you'll jump to that section of this Guide. After you complete the relevant recovery steps, in the event that it's not obvious that you're running normally, then come back to this flowchart to see what's next.



A 1.7.2 Turn On the Controller and establish a Correct "Standby" Condition

STEP (1) Turn ON the SpaceHarp controller using its Power On/Off Switch (located behind the "Stage LEDs").

You normally will see all of the LEDs animate on the controller after you turn the power ON.

B 1.7.3 Check AC-DC Power Connection

STEP (1) Check to make sure the DC Power Supply cable is firmly connected, and make sure the recommended correct Power Adapter is on the other end of that cable, and that in turn, is plugged into a good working 110V AC 50-60Hz power source.

Is the cable firmly plugged in?

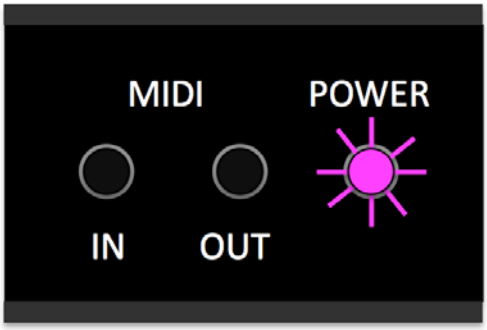
EXTREME CAUTION AND WARNING:
USE ONLY THE CORRECT AC-to-DC POWER ADAPTER!
If you must use a replacement, make sure it is the correct DC 5V 10A switching power supply with a 2.1mm DC plug having positive tip.
If you do NOT use the correct Power Adapter, you could possibly severely damage the SpaceHarp and require a hardware repair! Or, this could also even cause a fire!

The recommended Power Adapter is the Adafruit product ID # 658. Replacements are inexpensive and are readily available online. https://www.adafruit.com/product/658

STEP (2) After connecting a compatible Power Adapter cable to the SpaceHarp DC jack, and to a good AC source on the other end, switch the On/Off rocker switch at the controller's back to the ON, or upper position.

The Power LED indicator at front of the SpaceHarp should immediately light up a steady magenta color. The magenta color indicates that the Power Supply is operating normally and the controller is good to use.

Power On LED

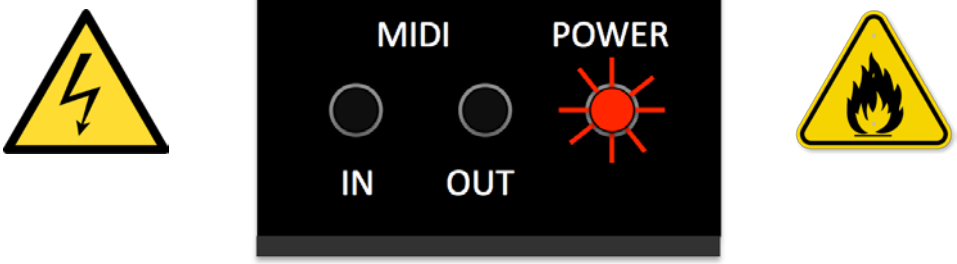


C

1.7.4 Replace Bad AC-DC Power Adapter

When you see a red and/or flickering POWER light, there is some kind of serious problem with the external Power Adapter (DC Power Supply).

Disconnect Bad Power Supply



STEP (1) Immediately turn the SpaceHarp power switch OFF.

STEP (2) Disconnect the suspected bad Power Supply, and set it aside for later testing by a skilled technician, or properly dispose of it.

STEP (3) Obtain a replacement Power Supply – (hopefully a backup you already have on-hand.) https://www.adafruit.com/product/658

STEP (4) Connect the known good Power Supply .

STEP (5) Turn the SpaceHarp back ON.

D

1.7.5 Adjust Ring LEDs Brightness Knob

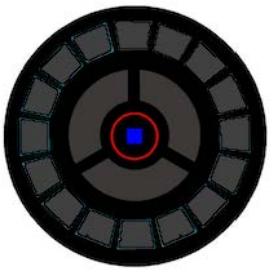
After it has completed its initial colorful boot-up and auto-calibration sequence and LED animations on the top of the controller stop (taking about 10 seconds), the SpaceHarp should look something like we show below. This will be the case whether or not any MIDI cables or foot pedals, are yet connected.

The outer Ring LEDs for all nine Sensor/LED modules on the controller's top surface should all be ON in their "standby" condition, which is a full circle of blue-colored LEDs all having the same hue. (They will also always return to this state after stopping any song in Sound Galaxy).

You'll also see the POWER On Status LED at front of the SpaceHarp is lit ON, so you know that the SpaceHarp power IS ON. (The Stage LEDs at the top may be either lit or dark.)

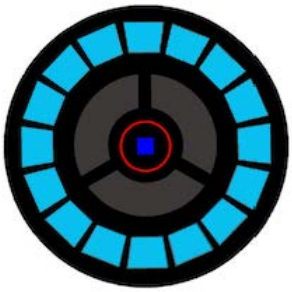
There are no LEDs lit inside any module; neither Inner LEDs nor outer Ring LEDs are lit. The Sensors LED BRIGHT control is probably turned all the way DOWN (to hard left).

In other words, each of the nine Sensor/LED Modules' looks like this:



STEP (1) Gently rotate the right-hand of the two LED BRIGHT knobs clockwise to about a 10-o'clock position:

After that, the ring LEDs will be in a good "standby" condition, all lit and all with the same blue color. You may see some random inner LEDs lit, if so, don't worry about that for now; (when you start playing with a host system including a Song Galaxy Song, those LEDs will reset.)



E 1.7.6 Adjust the Sonar

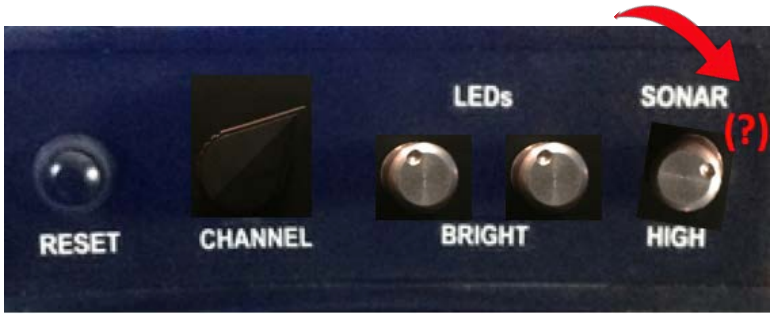
STEP (1) Gently rotate SONAR HIGH knob clockwise to about a 10-o'clock position. This 10-o'clock position sets the Sonar total range to about 3.5 feet above the controller. This is within easy reach for most players.

Whatever Sonar High is set has the full 128 MIDI values out for that range; the MIDI response auto-scales to any Sonar High selection.

It's alright to experiment with setting the Sonar higher, up to 1- or 2 o'clock positions which means 6-7 feet. This may or may not be practical with your particular Stand and Light Setup. A setting at MAX, namely at 4 o'clock sets "high," gives a Sonar total range out to 9 or 10 feet. This definitely takes care in setup, to avoid the sonar confusing the Sensor Light as part of a body.

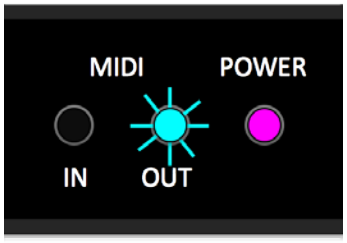
1.7.6.1 Discover and adjust Sonar to greatest possible height.

STEP (1) Turn the SONAR HIGH KNOB gently clockwise, being careful to not have your body over the controller.



STEP (2) Stop turning the SONAR HIGH KNOB as soon as you notice the SpaceHarp's MIDI OUT LED flickers blue color.

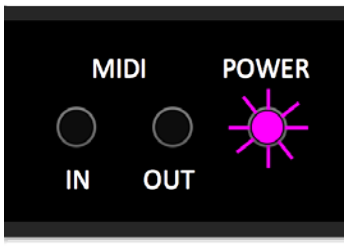
Sending Sonar MIDI Out



When you're otherwise sure nothing is over the SpaceHarp, this means that Sonar MIDI messages are being sent due to sensing the Light on your Stand setup. Now you know what's just *past* your maximum SONAR HIGH "limit."

STEP (3) Now "back-off" (turn left) the knob, counter-clockwise *just enough* so that the MIDI OUT LED goes dark.

No Sensor MIDI Out



This LED status means that nothing is being sensed, and no MIDI is being sent out – which is definitely what you want to see when you are not playing.

It's analogous to taking your fingers entirely off a piano's keys – (nothing should be happening).

F 1.7.7 Adjust Stage LEDs Brightness Knob

When “off” these LEDs appear white because they do not have any filter, and are “bare.”

The Stage LEDs BRIGHT control is probably turned all the way DOWN (i.e. to a hard counter-clockwise left.)

STEP (1) Gently turn the left-hand LED BRIGHT knob to the right, i.e. Clockwise, to about a 10-o’clock position.

It’s a good idea to keep this LED BRIGHT knob set to about 10-o’clock position.

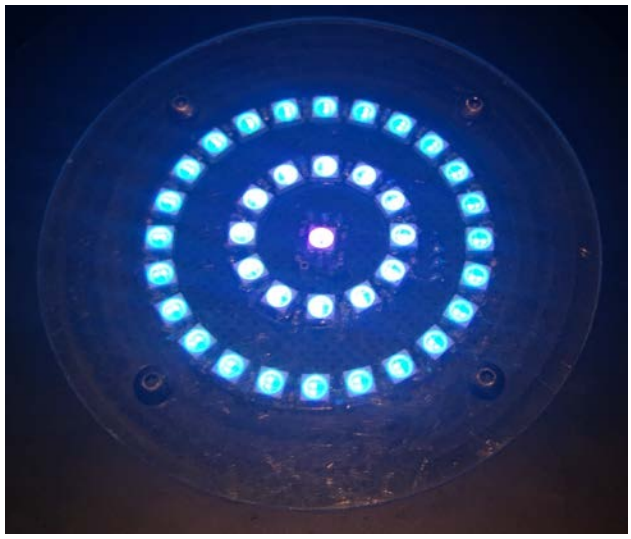
EXTREME CAUTION AND WARNING: Do Not turn the LED Brightness Knobs all the way clockwise to the right (full brightness) and leave them set at that level for more than a minute or so. This can possibly damage the LED boards. *This is an LE prototype controller issue only.*

We have marked “LED MAX” (i.e. maximum safe LED brightness) clearly on the prototype units. Please do not exceed it.

NEVER TURN LED BRIGHTNESS TO 100% AND LEAVE IT THERE*

(prototype LE units only.)

Now the “Stage” LEDs will look something like this (when ‘bare’ and with nothing on them.)



1.7.8 Controller seems "dead" when I move over it. Nothing Changes.

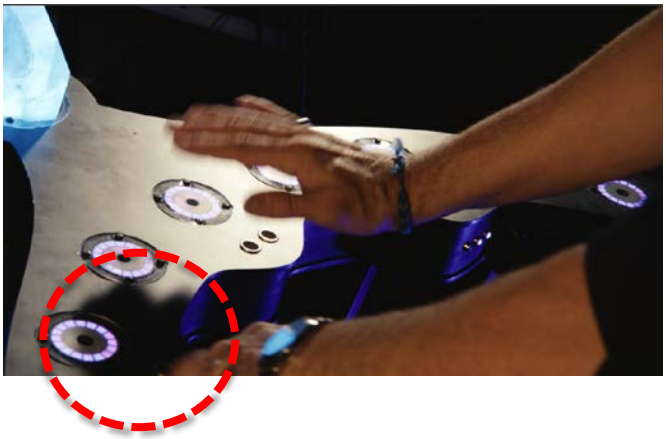
OK, so your SpaceHarp appears to be in its active but "Standby" status. You feel that everything in your physical setup is correct. You see a good Power LED and you see the "Ring" LEDS in their normal blue "standby" condition.

G

1.7.8.1 Test Trigger Sensors

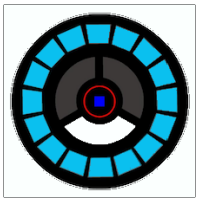
Sound Galaxy doesn't need to be loaded, but if it is, make sure in the PERFORMANCE and/or MIX Tabs that the Transport is STOPPED (song is stopped with location = 0.0.) In fact, you don't even need MIDI cables connected between the controller to anything else. This is solely a local test.

STEP (1) Move over your SpaceHarp in a way that you can see that your own shadow crosses over one or more of the shadow (motion) sensors.

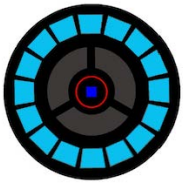


When the SpaceHarp is configured correctly, when you move over the sensors, you will see the inner/lower LED's light up. (They'll probably show the default 'white' color if you haven't yet launched Sound Galaxy. The color doesn't matter here.)

When shadowing sensors, you should see this:



not this:



The inside/lower LEDs do not light up and the SpaceHarp seems to have no shadow sensor functions.

Don't worry, it's probably not the SpaceHarp having a hardware failure; the SpaceHarp controller is extremely reliable and robust. It's probably something else, another issue that will be easy to verify and quick to correct.

Note that you should see the inside/lower LEDs light up from moving over the controller, even when no MIDI cables are connected to it. This is because those LEDs operate "locally" with the sensors, needing no external MIDI connection.

H

1.7.8.2 Make Sure the Sensor Illuminator Light is Turned ON

STEP (1) Plug in and/or turn ON the overhead light. It maybe unplugged or turned OFF for safety.

STEP (2) Slide the dimmer UP on the Illuminator Light Cord (if present) to maximum.

STEP (3) Push the controller's RESET button, and do not shadow it while it powers on.

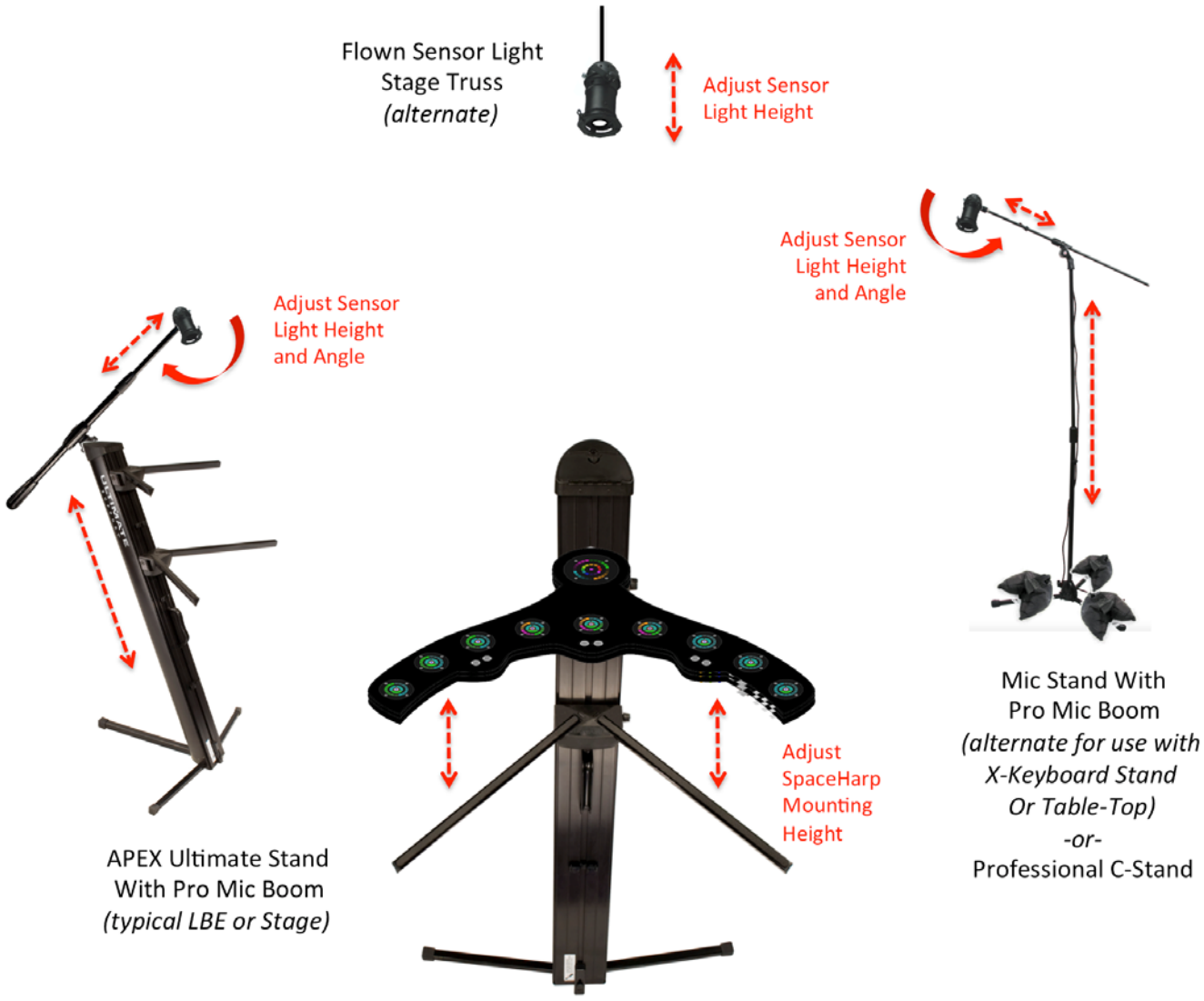
1.7.9 (Re-) Adjust the Sensor Illuminator Light

If some of the Trigger LEDs stay lit without shadowing them, then most likely the Sensor Illuminator Light has moved out of a normal operating position and orientation, so some of its light is missing the controller's surface, causing some Trigger Sensors to remain in a "Trigger" or "Note ON" state. This is easy to fix by adjusting the overhead light and/or SpaceHarp mounting height on its stand.

STEP (1) Adjust the height and/or angle of the light by using whatever your chosen stands and Sensor Light setup is, so that all the inner/lower LEDs are dark (OFF) when nothing is over (shadowing) the controller. A "best practice" light distance is 4 to 5 feet above the height of the controller. The Sensor Illuminator Light should be aimed at the center of the controller, and it only has to be approximate.

STEP (2) Push the controller's RESET button, and do not shadow it while it powers on.

STEP (3) Slide the dimmer DOWN on the Sensor Illuminator Light Cord, until at least one Trigger LED lights up. Then, slide the dimmer just enough UP (brighter) until all Trigger LEDS are off. Now you have the least amount of Illuminator Light needed to operate the controller Trigger Sensors.



WARNING: DO NOT TOUCH the overhead Halogen Sensor Illuminator Light PAR-16 housing when the lamp is turned ON. If you are changing gels, or changing bulbs, please turn OFF the light, first! *THE LIGHT CAN GET HOT! DON'T GET BURNED!*

WARNING: DO NOT LOOSEN the overhead light stand knob at its base, or move the light stand, in a way that allows it to fall onto the SpaceHarp which could *cause serious damage to the controller.*

When you setup, always make sure that any threads and knobs for your light mounting are completely tight, before you place the SpaceHarp underneath it; likewise, when you tear down, remove the controller first, then the light stand.

If you must position the light when it is ON and OVER the controller, then have someone help you by holding any stand with you, to prevent it falling down. Hold the light by the STAND, NOT by the PAR-16 housing, to prevent a burn injury.

J 1.7.10 Reset the SpaceHarp Controller

After you have made significant adjustments to the physical spaceharp mounting and/or adjusted the Sensor Illuminator Light position or orientation, then push either the RESET button located next to the DC power connection jack, or, push the reset button located on the front of the controller.

Either button will reset the SpaceHarp and boot it up. Step back and do not shadow the controller while it runs its Power-On animation and calibration routine. If you shadow the controller while it boots up, it will have an incorrect ambient light threshold.

(or)

Okay, you've adjusted your Sensor Illuminator light and now the SpaceHarp's inner/lower LEDs light up when you move over them. Great!

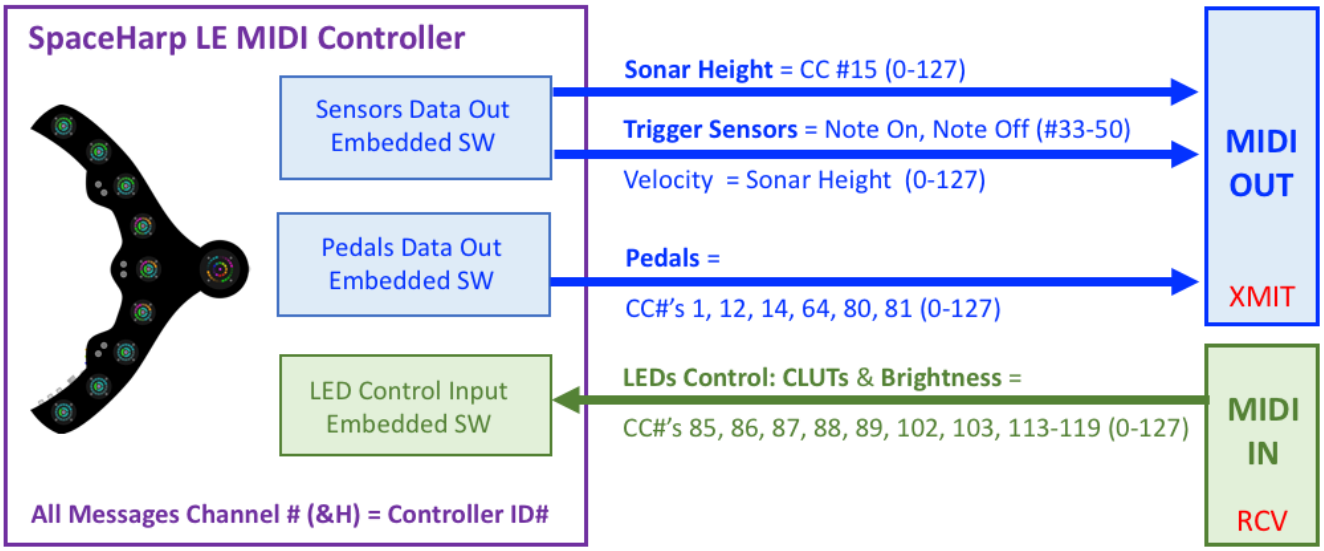
CONGRATULATIONS!
You have now established that the SpaceHarp Controller is ready and in a normal "Standby" condition.

1.8 CONTROLLER MIDI SPECIFICATION

1.8.1 MIDI Message Definitions

The correlation between specific MIDI message types and specific controller functions, are fixed as per this MIDI Specification and the SpaceHarp LE model hardware controller. That is, there are no message-to-function re-assignments nor message re-mapping functions inside the controller. Such mappings and assignments may however, be implemented external to the controller, in a way appropriate for a particular given DAW system setup.

1.8.2 SpaceHarp Controller MIDI Out (Transmit) and MIDI In (Receive)



The SpaceHarp controller has two MIDI protocols: **Data Transmission** from the controller's Sensor Section, and **Data Reception** into the controller's LED Section. The current Limited Edition (LE) model SpaceHarp controller has an intentionally limited MIDI protocol for simplicity and forward-compatibility with future software. Thus, it supports no transmitted messages regarding the controller's LED Section. Similarly, it recognizes no received messages to the controller's Sensor Section.

The SpaceHarp LE MIDI controller has very low-latency MIDI processing for sensors and messages. Over its DIN-5 serial MIDI, typical response times are under 5 milliseconds for any function.

1.8.3 Using the SpaceHarp Controller with Sound Galaxy and Other DAW Software

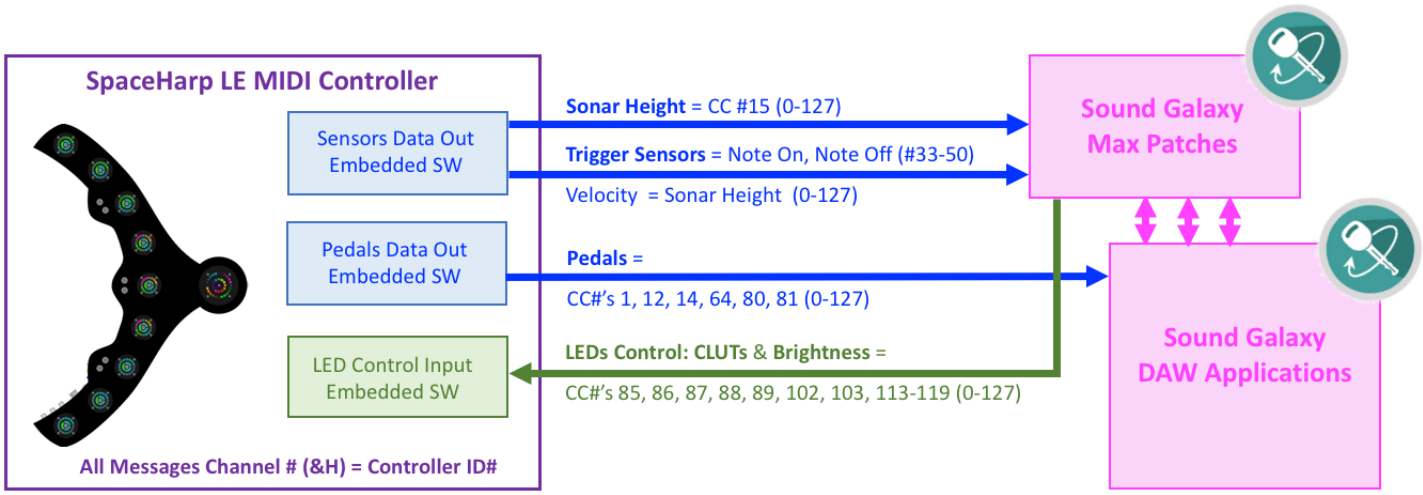
The Sound Galaxy 2.0 DAW Tools and Applications Suite implements a collection of data message (and data timing) mappings 'behind the scenes,' which leverages the controller's simple and limited MIDI protocol into an extremely wide scope of music and media control functions, and does so with great flexibility. In particular, Sound Galaxy enhances the use of the controller with these features:

- Realtime Trigger Attack Time Quantization and Auto-Sustain engine;"
- Automated management of SpaceHarp LEDs, colors and on/off states;
- Multi-stage effects pipeline and flexible effects routing for sonar, iOS and ring-accelerometers.
- High-level system control User Interface include optional use of touch-remotes;
- Automatic management of Hotz-Translator auto-harmonic engine;
- Routing and allocation of controllers and players over DAW soft-instrument

There are three variations of DAW System MIDI Setup that the SpaceHarp Controller may be used.

- Turn-Key Sound Galaxy MIDI Setup;
- Hybrid Sound Galaxy-Other DAW MIDI Setup;
- Custom MIDI Setup (other MIDI hardware and software)

1.8.3.1 Turn-Key Sound Galaxy MIDI Setup

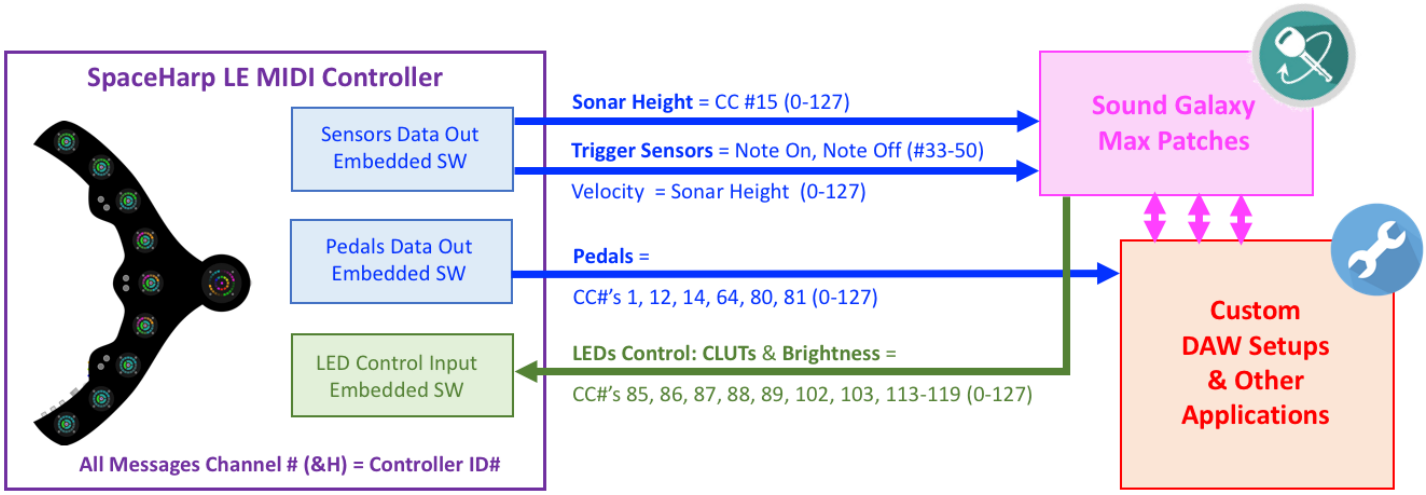


In this configuration, the full scope of features of SpaceHarp's DAW Tools Suite, **Sound Galaxy 2.0** are implemented. See the **Sound Galaxy 2.0 User Guide** for full functions and MIDI information.

Other than choosing the controller ID# using the SpaceHarp's channel select knob, there are no MIDI configurations, mappings, routings, or setups to attend to by the operator or player.

The default is a one-SpaceHarp system. Multi-SpaceHarp controller setups are also available as well.

1.8.3.2 Hybrid Sound-Galaxy/Other DAW Applications MIDI Setup

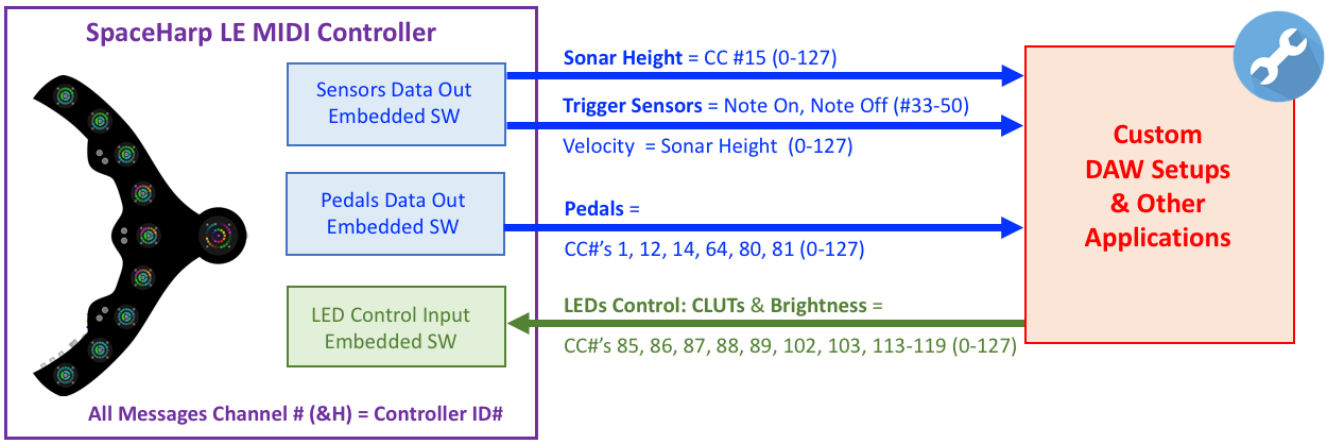


In this configuration, the essential functions of clock-synced Note On/Note Off time quantization and auto-sustain, as well as controller LEDs function, color and control are performed by certain parts of SpaceHarp's Sound Galaxy 2.0 DAW Tools Suite, namely the 'Notes Processor' and 'Delta Matrix' Max patches. The Performance and Mix tabs may also be used, but need patch customization in Max. This can be configured as "Turn-Key," so far as SpaceHarp players and performers are concerned.

Depending on the Other Applications and the desired system functions and features, this setup should only be implemented by experienced DAW users, Max programmers and/or studio MIDI/audio engineers. However, for development, setup, content authoring, instrument presets, track automation and other functions, many technical MIDI configurations, mappings, routings, and setups must be attended to by the DAW development engineer / producer / programmer. SpaceHarp's **Application Notes** address tips, tricks and techniques for these hybrid setups.

The default for such a "hybrid" setup using the essential Sound Galaxy Max Patches is a one-SpaceHarp system. Multi-SpaceHarp controller Max Patch setups are also available as well.

1.8.3.3 Custom MIDI System Setup



In this configuration, Sound Galaxy tools and modules are not used at all. The Controller's MIDI is directly connected to Other Applications, or even directly to other specialized hardware equipment.

The only LED functions are the "Trigger" (inner/lower) LEDs turning white color on shadow event, by its local embedded logic. Any other LED functions must be setup and controlled by other software. Sensor shadow trigger Notes On/Off are only timed by actual shadow/un-shadow events. Thus, without conditioning, Notes "duration" is "raw." That is, entirely by shadow control. Sweeping motions across sensors can result in very short Notes durations.

This setup, whether for one or multiple SpaceHarp controllers, should only be implemented by experienced DAW users, Max programmers and/or expert studio MIDI/audio engineers.

1.8.4 MIDI Channel Select Knob

For any particular SpaceHarp controller, the MIDI Channel for both Received Data and Transmitted Data is selected together using the MIDI Channel Selector Knob, thus setting the "Controller's MIDI Channel" to between 1 and 16. Channel 16 is the 12-o'clock position of the knob; clockwise clicks from there, increment 1 channel at a time from channel 1, 2, 3 and so forth. Thus Channel 2, for the first player, is two clicks clockwise from 12-o'clock.

The Channel Selector Knob requires a SpaceHarp Restart to take effect. Changing the knob position never transmits any MIDI message, instead it only affects the MIDI Channel values for subsequent Transmitted Messages and the definition of valid Received Messages intended for that hardware unit.

If using with Sound Galaxy DAW Tools, always set the Channel Selector Knob to Channel 2 for the first SpaceHarp, Channel 3 for the second SpaceHarp, Channel 4 for the third SpaceHarp and Channel 5 for the fourth SpaceHarp.

These channels are used for controller identification only, and have nothing to do with DAW Plug-in Channel numbers further "downstream" in the DAW environment. In Sound Galaxy, the DeltaMatrix MAX patch allows variable routing of 1-4 SpaceHarps into Ableton Live with the installed DAW Plug-Ins and adjusts the channels automatically.

See **Sound Galaxy 2.0 User Guide** for additional detailed information about how the SpaceHarp MIDI protocol integrates into that DAW environment.

1.8.5 Data Reception (LED Section)

1.8.5.1 Received Channel Voice Messages

1.8.5.1.1 Received Note On/Off Messages

- **Note On:** Not supported
- **Note Off:** Not supported

1.8.5.1.2 Received Control Change Messages

- **Control Change**
  - **LED Ring Color Group 1 (Controller Number 85)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 85 (55&H)
    - vv = 128-Hue Color Look Up Table RGB Index Value
      (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	55&H	85	vv&H	Ring LEDs 1st active arc segments CLUT

  - **LED Ring Color Group 2 (Controller Number 86)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 86 (56&H)
    - vv = 128-Hue Color Look Up Table RGB Index Value
      (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	56&H	86	vv&H	Ring LEDs 2nd active arc segments CLUT

  - **LED Ring Color Group 3 (Controller Number 87)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 87 (57&H)
    - vv = 128-Hue Color Look Up Table RGB Index Value
      (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	57&H	87	vv&H	Ring LEDs 3rd active arc segments CLUT

- **LED Ring Color Group 4 (Controller Number 88)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 88 (58&H)
  - vv = 128-Hue Color Look Up Table RGB Index Value
    (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	58&H	88	vv&H	Ring LEDs 4th active arc segments CLUT

- **LED Ring Control Number of Active Arcs (Controller Number 89)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 89 (59&H)
  - vv = Index to table of Number of Active LED Segment Arcs in Ring-LEDs.
  - In practice immediately followed by Controller 85, 86, 87 and 88 messages for CLUT index to active segments 1, 2, 3 and 4 (i.e. One CC message for each of the LED ring segment arcs that are active.)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	3rd Byte Dec.	Comment
Bn&H	59&H	89	vv&H	vv	No. of Active Arc Segments:
Bn&H	59&H	89	00&H	0	O active LED arcs; standby
Bn&H	59&H	89	0C&H	12	1 active LED Segment Arc
Bn&H	59&H	89	25&H	37	2 active LED Segment Arcs
Bn&H	59&H	89	40&H	64	3 active LED Segment Arcs
Bn&H	59&H	89	59&H	89	4 active LED Segment Arcs

- **Inner-Lower LED CLUT (Controller Number 102)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 102 (66&H)
  - vv = 128-Hue Color Look Up Table RGB Index Value
    (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	66&H	102	vv&H	Inner/Lower LED CLUT

- **Inner-Upper LED CLUT (Controller Number 103)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 103 (6F&H)
  - vv = 128-Hue Color Look Up Table RGB Index Value
    (CLUT) 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	67&H	103	vv&H	Inner/Upper LED CLUT

- **Sensor ID #1 Inner-Upper LED On-Off (Controller Number 111)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 111 (6F&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #1:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	6F&H	111	vv&H	Inner/Upper LEDs dark/on state
Bn&H	6F&H	111	00&H	Inner/Upper LEDs dark state
Bn&H	6F&H	111	7F&H	Inner/Upper LEDs on state

- **Sensor ID #2 Inner-Upper LED On-Off (Controller Number 112)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 112 (70&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #2:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	70&H	112	vv&H	Inner/Upper LEDs dark/on state
Bn&H	70&H	112	00&H	Inner/Upper LEDs dark state
Bn&H	70&H	112	7F&H	Inner/Upper LEDs on state

- **Sensor ID #3 Inner-Upper LED On-Off (Controller Number 113)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 113 (71&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #3:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	71F&H	113	vv&H	Inner/Upper LEDs dark/on state
Bn&H	71F&H	113	00&H	Inner/Upper LEDs dark state
Bn&H	71F&H	113	7F&H	Inner/Upper LEDs on state

- **Sensor ID #4 Inner-Upper LED On-Off (Controller Number 114)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 114 (72&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #4:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	72&H	114	vv&H	Inner/Upper LEDs dark/on state
Bn&H	72&H	114	00&H	Inner/Upper LEDs dark state
Bn&H	72&H	114	7F&H	Inner/Upper LEDs on state

- **Sensor ID #5 Inner-Upper LED On-Off (Controller Number 115)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 115 (73&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #5:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	73&H	115	vv&H	Inner/Upper LEDs dark/on state
Bn&H	73&H	115	00&H	Inner/Upper LEDs dark state
Bn&H	73&H	115	7F&H	Inner/Upper LEDs on state

- **Sensor ID #6 Inner-Upper LED On-Off (Controller Number 116)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 116 (74&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #6:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	74&H	116	vv&H	Inner/Upper LEDs dark/on state
Bn&H	74&H	116	00&H	Inner/Upper LEDs dark state
Bn&H	74&H	116	7F&H	Inner/Upper LEDs on state

- **Sensor ID #7 Inner-Upper LED On-Off (Controller Number 117)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 117 (75&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #7:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	75&H	117	vv&H	Inner/Upper LEDs dark/on state
Bn&H	75&H	117	00&H	Inner/Upper LEDs dark state
Bn&H	75&H	117	7F&H	Inner/Upper LEDs on state

- **Sensor ID #8 Inner-Upper LED On-Off (Controller Number 118)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 118 (76&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #8:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	76&H	118	vv&H	Inner/Upper LEDs dark/on state
Bn&H	76&H	118	00&H	Inner/Upper LEDs dark state
Bn&H	76&H	118	7F&H	Inner/Upper LEDs on state

- **Sensor ID #9 Inner-Upper LED On-Off (Controller Number 119)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - Controller ID number 119 (77&H)
  - vv = Low or High Value, for status of Inner-Upper LED for Sensor ID #9:
    00&H for "dark" LED state, or 7F&H for "on" LED State; (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	77&H	119	vv&H	Inner/Upper LEDs dark/on state
Bn&H	77&H	119	00&H	Inner/Upper LEDs dark state
Bn&H	77&H	119	7F&H	Inner/Upper LEDs on state

1.8.5.2 Received Channel Mode Messages

Not supported.

1.8.5.3 Received System Realtime Messages

Not supported.

1.8.5.4 Received System Exclusive Message

Not supported.

1.8.6 Data Transmission (Sensor & Pedals Section)

1.8.6.1 Transmitted Channel Voice Messages

No trigger sensor MIDI messages and no sonar height messages are transmitted when the Sonar High Knob is turned all the way counter-clockwise (left). This knob position sets the controller in a **Local Only Mode** for sensors. MIDI Data Reception remains enabled however, while in **Local Only Mode**.

1.8.6.1.1 Transmitted Note On Messages

- **Note On**
  - Message is generated following a valid "shadow" action over a SpaceHarp trigger sensor. Fully 9-sensor "polyphonic" at all times.
  - Inner/Lower LED from a local control circuit changes to "on" state.
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller/player number."
  - kk = Note Number: 24&H - 32H (36 - 50 decimal);
    In practice, implemented values for the 2nd data byte are shown in the below table.
  - vv = Note On Velocity: 01&H – 7F&H (1-127)
    In practice, Note On Velocity equals the most recently detected relative sonar height value; also, the last transmitted sonar continuous CC ID#15 message.

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
8n&H	kk&H	kk	vv&H	(In general.)
8n&H	24&H	36	vv&H	Sensor #1
8n&H	26&H	38	vv&H	Sensor #2
8n&H	28&H	40	vv&H	Sensor #3
8n&H	29&H	41	vv&H	Sensor #4
8n&H	2B&H	43	vv&H	Sensor #5
8n&H	2D&H	45	vv&H	Sensor #6
8n&H	2F&H	47	vv&H	Sensor #7
8n&H	30&H	48	vv&H	Sensor #8
8n&H	32&H	50	vv&H	Sensor #9

1.8.6.1.2 Transmitted Note Off Messages

- **Note Off**
  - Message is generated following a valid “un-shadow” action over a SpaceHarp trigger sensor. Fully 9-sensor “polyphonic” at all times.
  - Inner/Lower LED from a local control circuit changes to “dark” state.
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = “controller ID/player number.”
    (For example: channel number 2 decimal (1&H) = controller ID of 1.)
  - kk = Note Number: 24&H - 32H (36 - 50 decimal);
    In practice, implemented values for the 2nd data byte are shown in the below table.
  - vv = Note Off Velocity: 00&H – 7F&H (0-127)
    In practice, Note Off Velocity equals the most recently detected sonar height value; also, the last transmitted sonar continuous CC ID#15 message (see Control Change below.)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
9n&H	kk&H	kk	vv&H	(In general.)
9n&H	24&H	36	vv&H	Sensor #1
9n&H	26&H	38	vv&H	Sensor #2
9n&H	28&H	40	vv&H	Sensor #3
9n&H	29&H	41	vv&H	Sensor #4
9n&H	2B&H	43	vv&H	Sensor #5
9n&H	2D&H	45	vv&H	Sensor #6
9n&H	2F&H	47	vv&H	Sensor #7
9n&H	30&H	48	vv&H	Sensor #8
9n&H	32&H	50	vv&H	Sensor #9

  - The 3-byte message 8n&H, kk&H, 00&H (Note On Message type with zero velocity) is never transmitted for an un-shadow trigger event. The Note Off MIDI message type alone is supported for un-shadow trigger event messages.
  - SpaceHarp’s handling of velocity values by sonar height separately for Note On (shadow) and Note Off (un-shadow) messages is a unique characteristic of this controller. It means for example, you can shadow a trigger sensor at one height, move your body (or prop) to change height while keeping the sensor shadowed, and then release (un-shadow) at a different height. It’s up to the particular DAW MIDI processing environment to exploit this unique feature.

1.8.6.1.3 Transmitted Control Change Messages

- **Control Change**
  - **Modulation (Controller Number 1)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 1 (01&H)
    - vv = Low to High Value of connected Foot Pedal #1 on SpaceHarp controller: continuous controller 00&H – 7F&H (0-127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	01&H	1	vv&H	Foot Pedal 1

  - **All Notes Off (Controller Number 12)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 12 (0C&H)
    - vv = Low or High Value of connected Foot Switch #2 on SpaceHarp controller: 00&H or 7F&H (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	0C&H	12	vv&H	Foot Switch 2
Bn&H	0C&H	12	00&H	Pedal Up
Bn&H	0C&H	12	7F&H	Pedal Down

  - **Undefined (Controller Number 14)**
    - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
      In practice, n = "controller ID/player number."
      (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
    - Controller ID number 14 (0E&H)
    - vv = Low to High Value of connected Foot Pedal #2 on SpaceHarp controller: continuous controller 00&H – 7F&H (0-127)
    - User-definable message function in their specific DAW environment.

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	0E&H	12	vv&H	Foot Pedal 2

- **Height (Controller Number 15)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - 15 = Controller ID number 15 (&0F)
  - vv = Detected Height: Value: 00&H – 7F&H (0-127)
    In practice, equals the most recently sonar-detected global height value. The value auto-Scales according to the position of the Sonar High Knob on the controller. See the Sonar Auto-Scaling of MIDI Response to Sonar High Setting section.

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	0F&H	15	vv&H	(In general.)

- **Sustain (Controller Number 64)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - 64 = Controller ID number 12 (40&H)
  - vv = Low or High Value of connected Foot Switch #1 on SpaceHarp controller: 00&H "off" or 7F&H "on" (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	40&H	64	vv&H	Foot Switch 1
Bn&H	40&H	64	00&H	Pedal Up
Bn&H	40&H	64	7F&H	Pedal Down

- **Transpose Down (General Purpose Controller Number 80)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - 64 = Controller ID number 12 (40&H)
  - vv = Low or High Value of connected Foot Switch #3 on SpaceHarp controller: 00&H or 7F&H (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	40&H	80	vv&H	Foot Switch 3
Bn&H	40&H	80	00&H	Pedal Up
Bn&H	40&H	80	7F&H	Pedal Down

- **Transpose Up (General Purpose Controller Number 81)**
  - n = MIDI Channel Number: 0&H - F&H (ch. 1-16);
    In practice, n = "controller ID/player number."
    (For example: channel number 2 decimal (1&H) = controller ID of 1 or player 1.)
  - 64 = Controller ID number 12 (40&H)
  - vv = Low or High Value of connected Foot Switch #4 on SpaceHarp controller: 00&H or 7F&H (0 or 127)

Status Byte	2nd Byte Hex	2nd Byte Dec.	3rd Byte Hex	Comment
Bn&H	40&H	81	vv&H	Foot Switch 4
Bn&H	40&H	81	00&H	Pedal Up
Bn&H	40&H	81	7F&H	Pedal Down

1.8.6.2 Channel Mode Messages

Not supported.

1.8.6.3 System Realtime Messages

Not supported.

1.8.6.4 System Exclusive Message

Not supported.

1.8.7 Additional Helpful MIDI Information

1.8.7.1 Number Formats Conversion Table

Dec	Hex	Oct	Bin
0	0	000	00000000
1	1	001	00000001
2	2	002	00000010
3	3	003	00000011
4	4	004	00000100
5	5	005	00000101
6	6	006	00000110
7	7	007	00000111
8	8	010	00001000
9	9	011	00001001
10	A	012	00001010
11	B	013	00001011
12	C	014	00001100
13	D	015	00001101
14	E	016	00001110
15	F	017	00001111
16	10	020	00010000
17	11	021	00010001
18	12	022	00010010
19	13	023	00010011
20	14	024	00010100
21	15	025	00010101
22	16	026	00010110
23	17	027	00010111
24	18	030	00011000
25	19	031	00011001
26	1A	032	00011010
27	1B	033	00011011
28	1C	034	00011100
29	1D	035	00011101
30	1E	036	00011110
31	1F	037	00011111
32	20	040	00100000
33	21	041	00100001
34	22	042	00100010
35	23	043	00100011
36	24	044	00100100
37	25	045	00100101
38	26	046	00100110
39	27	047	00100111
40	28	050	00101000
41	29	051	00101001
42	2A	052	00101010
43	2B	053	00101011
44	2C	054	00101100
45	2D	055	00101101
46	2E	056	00101110
47	2F	057	00101111
48	30	060	00110000
49	31	061	00110001
50	32	062	00110010
51	33	063	00110011
52	34	064	00110100
53	35	065	00110101
54	36	066	00110110
55	37	067	00110111
56	38	070	00111000
57	39	071	00111001
58	3A	072	00111010
59	3B	073	00111011
60	3C	074	00111100
61	3D	075	00111101
62	3E	076	00111110
63	3F	077	00111111
64	40	100	01000000
65	41	101	01000001
66	42	102	01000010
67	43	103	01000011
68	44	104	01000100
69	45	105	01000101
70	46	106	01000110
71	47	107	01000111
72	48	110	01001000
73	49	111	01001001
74	4A	112	01001010
75	4B	113	01001011
76	4C	114	01001100
77	4D	115	01001101
78	4E	116	01001110
79	4F	117	01001111
80	50	120	01010000
81	51	121	01010001
82	52	122	01010010
83	53	123	01010011
84	54	124	01010100
85	55	125	01010101
86	56	126	01010110
87	57	127	01010111
88	58	130	01011000
89	59	131	01011001
90	5A	132	01011010
91	5B	133	01011011
92	5C	134	01011100
93	5D	135	01011101
94	5E	136	01011110
95	5F	137	01011111
96	60	140	01100000
97	61	141	01100001
98	62	142	01100010
99	63	143	01100011
100	64	144	01100100
101	65	145	01100101
102	66	146	01100110
103	67	147	01100111
104	68	150	01101000
105	69	151	01101001
106	6A	152	01101010
107	6B	153	01101011
108	6C	154	01101100
109	6D	155	01101101
110	6E	156	01101110
111	6F	157	01101111
112	70	160	01110000
113	71	161	01110001
114	72	162	01110010
115	73	163	01110011
116	74	164	01110100
117	75	165	01110101
118	76	166	01110110
119	77	167	01110111
120	78	170	01111000
121	79	171	01111001
122	7A	172	01111010
123	7B	173	01111011
124	7C	174	01111100
125	7D	175	01111101
126	7E	176	01111110
127	7F	177	01111111

1.8.7.2 Industry Standard (Defined) MIDI Controllers List

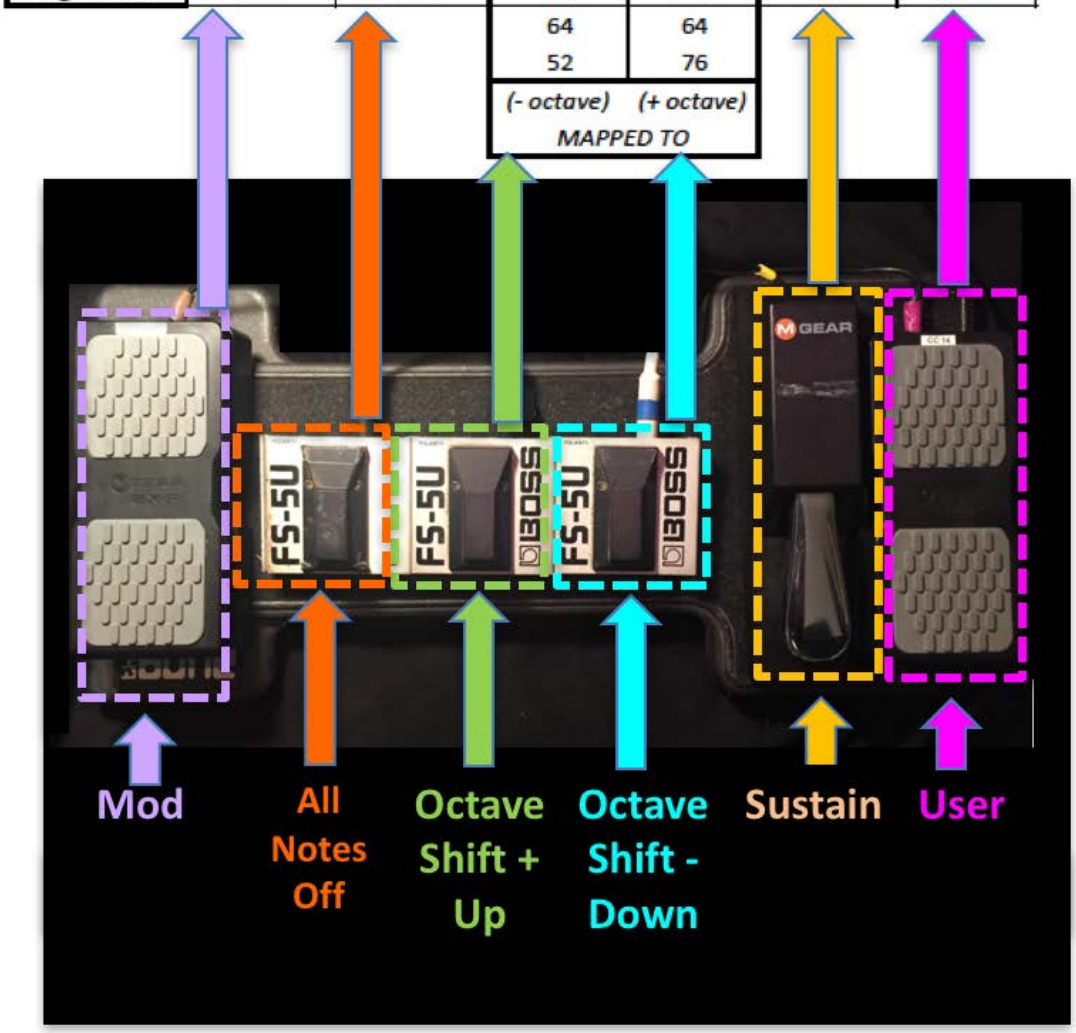
Decimal	Hex	Controller Name
0	00&H	Bank Select (Controller # 32 more commonly used)
1	01&H	Modulation Wheel
2	02&H	Breath Controller
3	03&H	Undefined
4	04&H	Foot Controller
5	05&H	Portamento Time
6	06&H	Data Entry MSB
7	07&H	Main Volume
8	08&H	Balance

Decimal	Hex	Controller Name
9	09&H	Undefined
10	0A&H	Pan
11	0B&H	0Ch
12	0C&H	Effect Control 1
13	0D&H	Effect Control 2
14-15	0E-0F&H	Undefined
16-19	10-13&H	General Purpose Controllers (Nos. 1-4)
20-31	14-1F&H	Undefined
32-63	20-3F&H	LSB for Controllers 0-31 (rarely implemented)
64	40&H	Damper Pedal (Sustain) [Data Byte of 0-63=0ff, 64-127=On]
65	41&H	Portamento
66	42&H	Sostenuto
67	43&H	Soft Pedal
68	44&H	Legato Footswitch
69	45&H	Hold 2
70	46&H	Sound Controller 1 (default: Sound Variation)
71	47&H	Sound Controller 2 (default: Timbre/Harmonic Content)
72	48&H	Sound Controller 3 (default: Release Time)
73	49&H	Sound Controller 4 (default: Attack Time)
74	4A&H	Sound Controller 5 (default: Brightness)
75-79	4B-4F&H	Sound Controller 6-10 (no defaults)
80-83	50-53&H	General Purpose Controllers (Nos. 5-8)
84	54&H	Portamento Control
85-90	55-5A&H	Undefined
91	5B&H	Effects 1 Depth (previously External Effects Depth)
92	5C&H	Effects 2 Depth (previously Tremolo Depth)
93	5D&H	Effects 3 Depth (previously Chorus Depth)
94	5E&H	Effects 4 Depth (previously Detune Depth)
95	5F&H	Effects 5 Depth (previously Phaser Depth)
96	60&H	Data Increment
97	61&H	Data Decrement
98	62&H	Non-Registered Parameter Number LSB

Decimal	Hex	Controller Name
99	63&H	Non-Registered Parameter Number LSB
100	64&H	Registered Parameter Number LSB
101	65&H	Registered Parameter Number MSB
102-120	66-78&H	Undefined
121	79&H	Reset All Controllers
122	7A&H	Local Control
123	7B&H	All Notes Off
124	7C&H	Omni Off
125	7D&H	Omni On
126	7E&H	Mono On (Poly Off)
127	7F&H	Poly On (Mono Off)

1.8.8 Hardware Foot Pedals & Switches: MIDI Setup

	PED 1	SW 2	SW 3	SW 4	SW1	PED 2
	Continuous	*momentary*	*momentary*	*momentary*	*momentary*	*Continuous*
CC #	CC1	CC12	CC80	CC81	CC64	CC14
FUNCTION	MOD	ALL NOTES OFF	XPOSE DN	XPOSE UP	SUSTAIN	USER
low value	0	0	0	0	0	0
high value	127	127	127	127	127	127
			64	64		
			52	76		
			(- octave)	*(+ octave)*		
			MAPPED TO			



1.9 HARDWARE REFERENCE

1.9.1 Warnings, Cautions and Notices

1.9.1.1 Explanation of Symbols Used in this Guide

IMPORTANT NOTE: The exclamation point inside the triangle symbol, is intended to alert the user to the presence of important operating instructions in this Guide. These are most often specific actions to avoid doing, in order to prevent unpredictable results, or which result in the unstable or other unintended functioning of the unit.

ELECTRICAL SHOCK HAZARD: The lightning flash inside the triangle symbol, is intended to alert the user to the presence of un-insulated “dangerous voltage” within the product’s enclosure that may be of sufficient magnitude to constitute a risk of electrical shock, as to the particular circumstances described in that section of this Guide.

FIRE HAZARD: The flames inside the triangle symbol, is intended to alert the user to the possibility of fire and/or burn injury, as to the particular circumstances described in that section of this Guide.

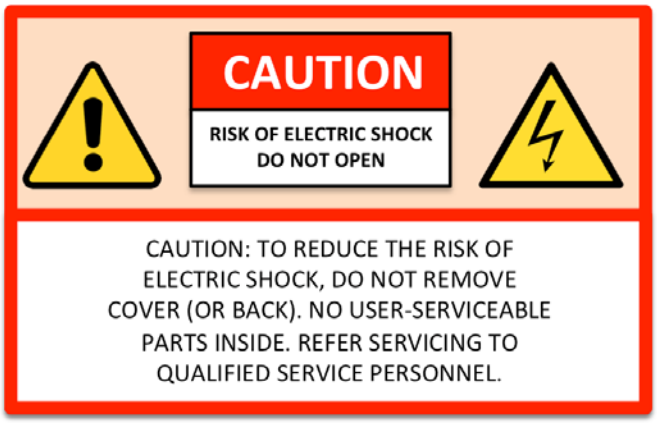
WARNING: The exclamation point within a “stop sign” symbol is intended to alert the user to the potential for serious damage to the unit and/or it’s connected system and/or accessories. This symbol is also used to warn the user against “manual tampering” with some of the behind-the-scenes MIDI setups in the system, which are used and managed by all the Sound Galaxy Suite of DAW applications.

TIP: The “light bulb” symbol is intended to alert the user to a helpful tip, an interesting good practice, a time saving measure or other useful information. This symbol doesn’t indicate anything required or critical, but rather something that is often just a good idea.

1.9.1.2 Important Safety Instructions

- Read these instructions.
- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Do not use this apparatus near water.
- Do not expose to rain, water mist or moisture.
- Clean only with dry cloth.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet.

- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified provided by the manufacturer.
- Use only with the stand, bracket, or table specified and/or recommended by the manufacturer, or sold with the apparatus. When a stand is used, use caution when moving the stand/apparatus combination to avoid injury from tip-over.
- Unplug this apparatus during lightning storms or when unused for long periods of time.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, the apparatus has been exposed to rain or moisture, does not operate normally, or has been dropped.
- Do not open the unit.



The above warning label is located on the back (underside) of the unit.

1.9.1.3 Warnings

Always follow the basic precautions listed below to avoid the possibility of serious injury or even death from electrical shock, short-circuiting, damages, fire or other hazards. These precautions include, but are not limited to, the following:

1.9.1.3.1 Power Supply / Power Cord

- Do not place the power cord near heat sources such as heaters or radiators. Also, do not excessively bend or otherwise damage the cord, or place heavy objects on it.
- Only use the voltage specified as correct for the controller. The required voltage, DC 5V 10A +tip, is also labeled at the SpaceHarp's DC Power connection jack.
- Use only the supplied power adapter with its supplied cord/plug.
- Check the electric plug periodically and remove any dirt or dust which may have accumulated on it.
- Be sure to connect to an appropriate AC outlet with a protective grounding connection. Improper grounding can result in electrical shock or damage to the controller.

1.9.1.3.2 Do Not Open

- This instrument contains no user-serviceable parts. Do not open the instrument or attempt to disassemble or modify the internal components in any way. If it should appear to be malfunctioning, discontinue use immediately and have it inspected by qualified SpaceHarp Corporation service personnel.

1.9.1.3.3 Water Warning

- Do not expose the instrument to rain, use it near water or in damp or wet conditions, or place on it any containers (such as vases, bottles or glasses) containing liquids which might spill into any openings. If any liquid such as water seeps into the instrument, turn off the power immediately and unplug the power cord from the AC outlet. Then have the instrument inspected by qualified SpaceHarp Corporation or other authorized service personnel.
- Never insert or remove an electric plug with wet hands.

1.9.1.3.4 Fire Warning

- Do not put burning items, such as incense or candles, on the unit. A burning item may fall over and cause a fire.

1.9.1.3.5 If you notice other unusual problems

If one of the following problems happens, immediately turn off the power switch and disconnect the Power Adapter from the SpaceHarp and from the AC power. Then have the SpaceHarp controller and power supply inspected by SpaceHarp service personnel.

- The power cord or plug becomes frayed or damaged. Replace it.
- The unit or its power adapter emits unusual smells or smoke. Replace it.
- Some object has been dropped into one of the six Sonar Sensor apertures, and which otherwise won't come loose from turning the controller upside down (carefully).

1.9.1.4 Cautions

Always follow the basic precautions listed below to avoid the possibility of physical injury to you or others, or damage to the instrument or other property. These precautions include, but are not limited to, the following:

1.9.1.4.1 Power Supply / Power Cord

- Do not place the power adapter or its cord near heat sources such as heaters or radiators. Also, do not excessively bend or otherwise damage the cord, or place heavy objects on it.
- Do not connect the instrument to an electrical outlet using a multiple-connector. Doing so can result in lower sound quality, or possibly cause overheating in the outlet.
- When removing the DC Power Supply plug from the instrument, always hold the plug itself and not the cord. Pulling by the cord can damage it.
- Remove the Power Adapter's electric plug from the AC outlet when the instrument is not to be used for extended periods of time, or during electrical storms.

1.9.1.4.2 Position and Transportation

- Do not place the instrument in an unstable position where it might accidentally fall over.
- Before moving the instrument, remove all connected cables, to prevent damage to the cables or injury to anyone who might trip over them.
- When setting up the product, make sure that the AC outlet you are using is easily accessible. If some trouble or malfunction occurs, immediately turn off the power switch and disconnect the Power Adapter from the unit. Even when the power switch is turned off, electricity is still flowing to the product at the minimum level. When you are not using the product for a long time, make sure to unplug the Power Adapter's power cord from the wall AC outlet.

1.9.1.4.3 Connections

- Before connecting SpaceHarp to other electronic components, turn off the power for all components. Before turning the power on or off for all components, set all volume levels on Amplified Speakers or Amplifiers to the minimum.
- Be sure to set the volumes of all components at their minimum levels and gradually raise the volume controls while playing the instrument to set the desired listening level.

1.9.1.4.4 Other Cautions

- Never insert or drop paper, metallic, or other objects into the Sonar Sensor apertures. This could cause physical injury to you or others, damage to the instrument or other property, or operational failure.
- Do not rest your weight on, or place heavy objects on the SpaceHarp, and do not use excessive force on the buttons, switches or connectors.
- Do not use the SpaceHarp and its connected digital audio interface or other device using headphones for a long period of time at a high or uncomfortable volume level, since this can cause permanent hearing loss. If you experience any hearing loss or ringing in the ears, consult a physician.

1.9.1.5 Notices

1.9.1.5.1 Specifications Subject to Change

The information contained in this manual is believed to be correct at the time of printing. However, SpaceHarp Corporation reserves the right to change or modify any of the specifications without notice or obligation to update existing units.

1.9.1.5.2 Disposal of Unit

Should this product become damaged beyond repair, or for some reason it's useful life is considered to be at an end, please observe all local, state, and federal regulations that relate to the disposal of products that contain lead, batteries, plastics, etc.

1.9.1.5.3 Repair Service Charges

Service charges incurred due to lack of knowledge relating to how a function or effect works (when the unit is operating as designed) are not covered by the manufacturer's warranty, and are therefore the owner's responsibility. Please study this manual carefully and consult SpaceHarp Corporation before requesting repair service.

1.9.1.5.4 Physical Handling

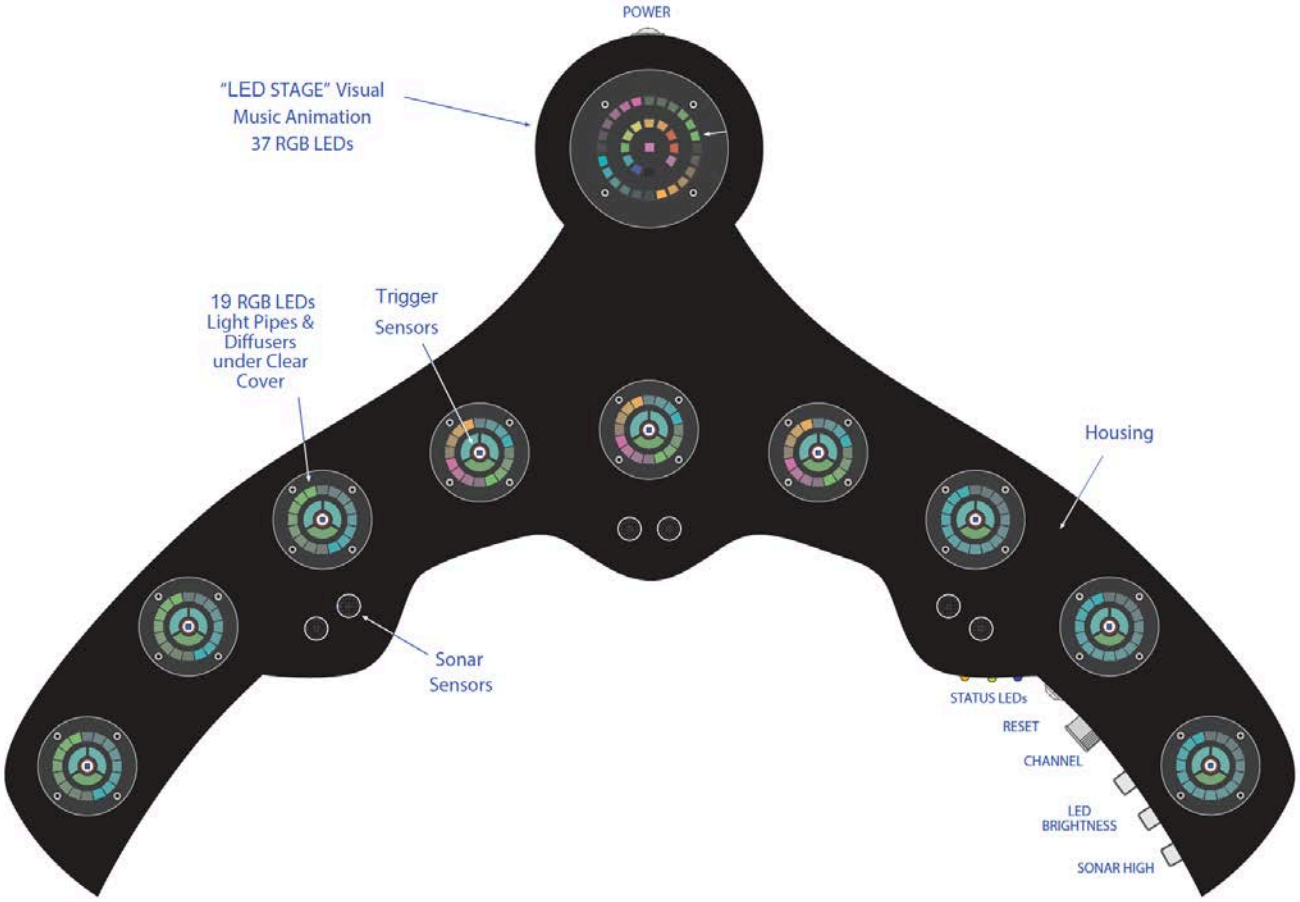
Do not expose the SpaceHarp controller to excessive dust or vibrations, or extreme cold or heat (such as in direct sunlight, near a heater, or in a car during the day) to prevent the possibility of panel disfiguration, damage to the internal components or unstable operation.

- Do not place vinyl, plastic or rubber objects on the controller, since this might discolor the ABS plastic top panel.
- When cleaning the controller, use a soft and dry/slightly damp cloth. Do not use paint thinners, solvents, alcohol, cleaning fluids, or chemical-impregnated wiping cloths.

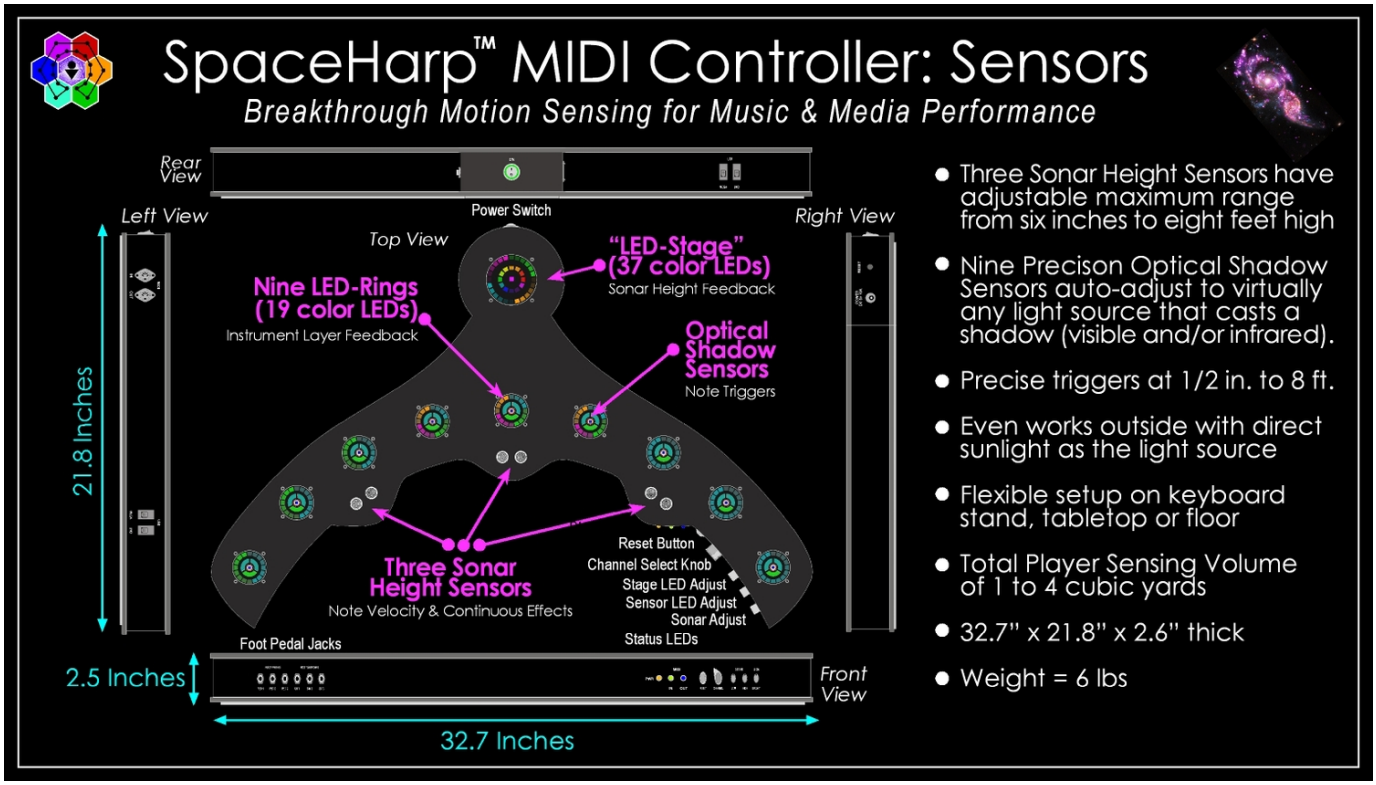
1.9.1.5.5 About this Guide

- The figures and computer display screens as shown in the Sound Galaxy User Guide portion of this document are for instructional purposes only, and may look somewhat different from those in your particular system setup.
- Apple, iTunes, Mac, Macintosh, iPhone, iPad and iPod touch are trademarks of Apple Inc., registered in the U.S. and other countries.
- iOS is a trademark or registered trademark of Cisco in the U.S. and other countries and is used under license.
- The company names and product names in this manual are the trademarks or registered trademarks of their respective companies.

1.9.2 SpaceHarp Hardware Features

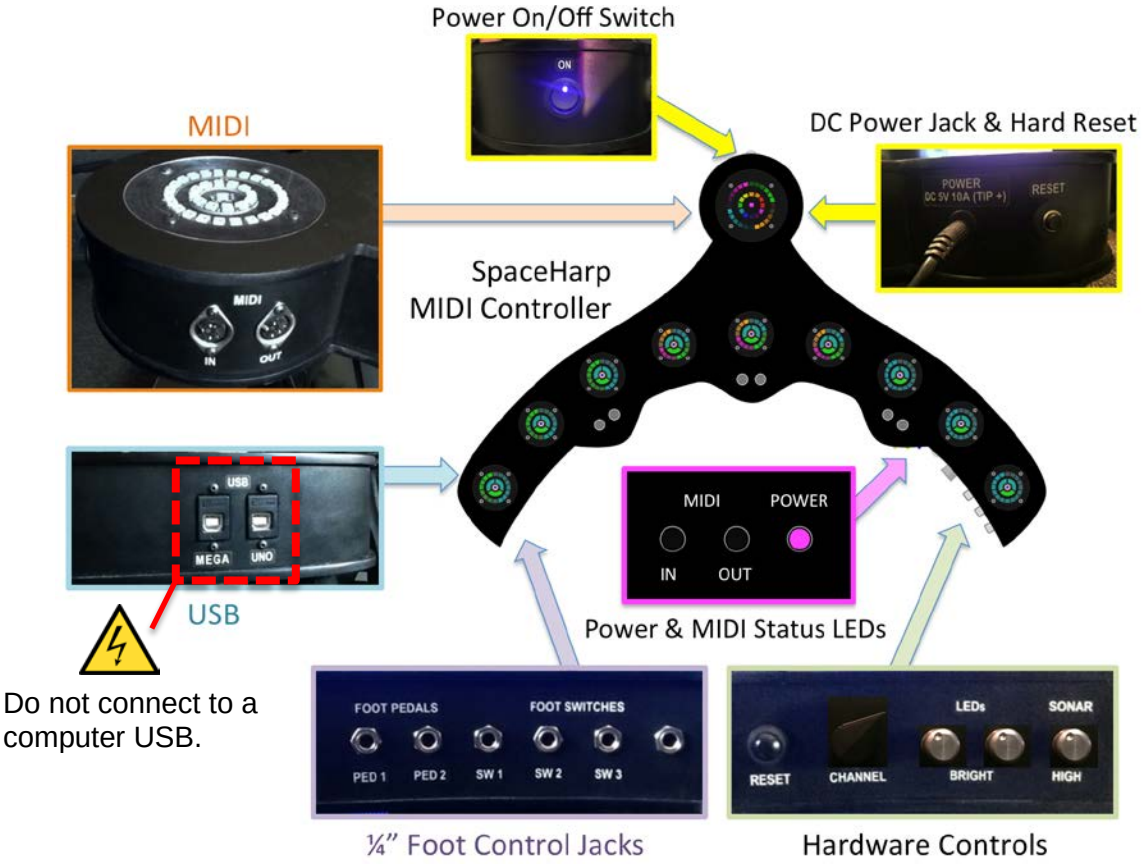


- Controller size: 21" x 34" x 2.5" thick;
- Rugged ABS Plastic Housing, in a beautiful winged shape;
- Controller Weight: 6 pounds;
- 9 optical shadow transition sensors for MIDI Note On/Note Off with Velocity;
- 3 ultrasonic ranging sensors producing a proprietary combined height CC#15 parameter;
- 171 full-color LEDs surround the set of sensors, providing instant clear feedback;
- LED status indicators for communications are multi-color-coded, for MIDI in, MIDI Out, and Power;
- Heavy duty panel-mounted jacks, rugged knobs and switches are for Pro environments;
- Heavy duty 10A circuit breaker and protection circuit;
- 16-Channel device select;
- Unique 37-LED "Mini-Stage" can be used for a variety of visual effects in addition to sonar height feedback, including with crystals, 3D-printed art, and more;
- Adjustment knobs for Sonar height, Sensor LED brightness, Mini-Stage LED brightness;
- (2) Continuous Foot Controller jacks, MIDI Out;
- (4) Foot Switch (momentary) jacks, MIDI Out


SpaceHarp™ MIDI Controller: Sensors
Breakthrough Motion Sensing for Music & Media Performance
Rear View
Power Switch
Left View
Top View
Right View
"LED-Stage" (37 color LEDs)
Sonar Height Feedback
Nine LED-Rings (19 color LEDs)
Instrument Layer Feedback
Optical Shadow Sensors
Note Triggers
21.8 Inches
Reset Button
Channel Select Knob
Stage LED Adjust
Sensor LED Adjust
Sonar Adjust
Status LEDs
Three Sonar Height Sensors
Note Velocity & Continuous Effects
Foot Pedal Jacks
2.5 Inches
Front View
32.7 Inches
Three Sonar Height Sensors have adjustable maximum range from six inches to eight feet high
Nine Precison Optical Shadow Sensors auto-adjust to virtually any light source that casts a shadow (visible and/or infrared).
Precise triggers at 1/2 in. to 8 ft.
Even works outside with direct sunlight as the light source
Flexible setup on keyboard stand, tabletop or floor
Total Player Sensing Volume of 1 to 4 cubic yards
32.7" x 21.8" x 2.6" thick
Weight = 6 lbs

1.9.3 SpaceHarp Hardware Connections & Controls

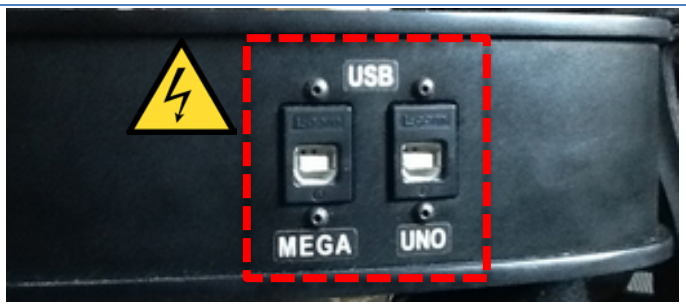
1.9.3.1 Locations of Connections & Controls on the SpaceHarp



1.9.3.2 USB Cable Connections

- USB ports are used for authorized hardware servicing only.

Never connect to a computer USB. You could damage SpaceHarp's internal CPU electronics.



USB are for servicing - NOT TO HOST COMPUTER

1.9.3.3 Audio Jacks for Foot Pedal Connections

- Two Continuous Expression Pedal ¼" Jacks (TRS)
- Four Foot Switch ¼" Jacks (mono)
- SpaceHarp hardware converts switch and pedal voltages to MIDI Continuous Controller messages sent 'Out' on currently selected MIDI Channel.

Direct Connection of Analog Hardware Outputs MIDI

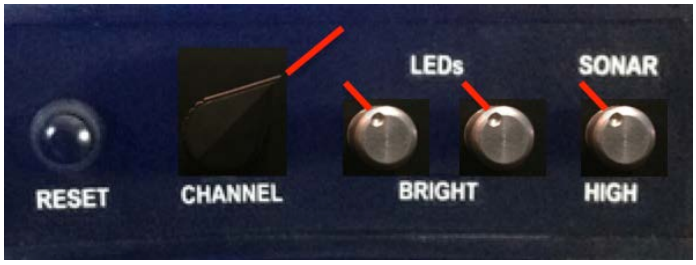
1.9.3.4 SpaceHarp MIDI In/Out Connections

- MIDI IN, MIDI OUT serial 5-pin DIN jacks
- Serial MIDI Allows for easy technical support and other applications without a computer or Sound Galaxy
- See MIDI Specification Section for details

MIDI IN/OUT Jacks are located on the “LED Stage”

1.9.3.5 SpaceHarp Hardware Controls

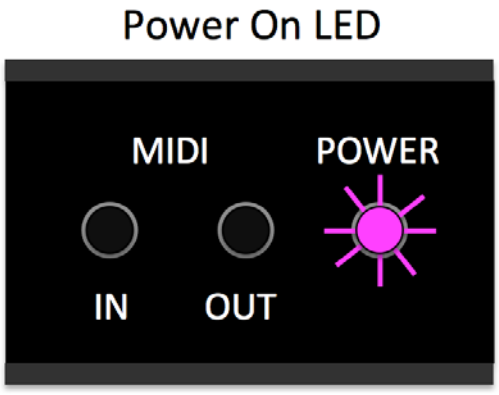
- Channel Knob: selects MIDI In/Out Channel to 1-16
- Sound Galaxy supports up to four simultaneously connected SpaceHarps set to MIDI Channels 2, 3, 4 and 5 respectively
- Reset Button reads Channel Knob State and sets MIDI Input and Output to that channel, and re-initializes the Sensors
- LED brightness adjust knobs
- Sonar Maximum Height adjustment knob: 9” to 9 feet from controller’s surface



SpaceHarp Controls Showing “Best Practice” Settings

1.9.3.6 Power and MIDI Status LEDs

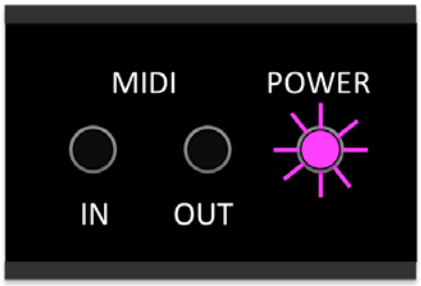
- MIDI “IN” LED flashes to show incoming MIDI messages
- MIDI “OUT” LED flashes cyan colors for Sonar (Height CC #15) vs. magenta color for trigger (Note ON/OFF w/ velocity
- Power LED shows “good” vs. “bad” Power Adapter status



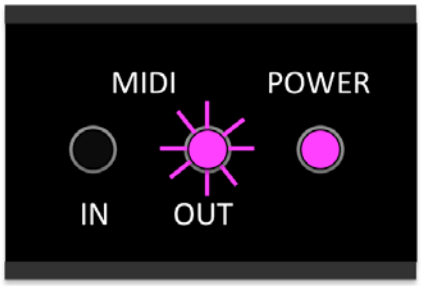
Power and MIDI Status LEDs at SpaceHarp Front Edge

Note the various states that you might find the LED indicators:

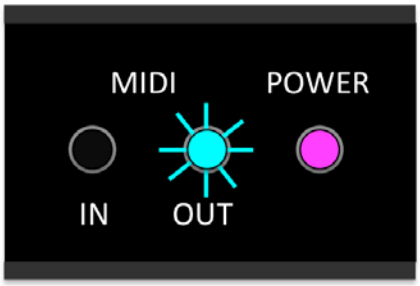
Power On LED



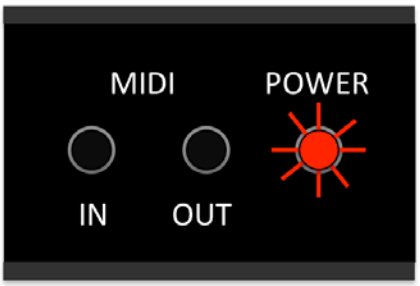
Sending Triggers MIDI Out



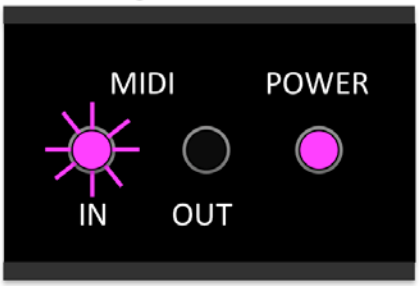
Sending Sonar MIDI Out



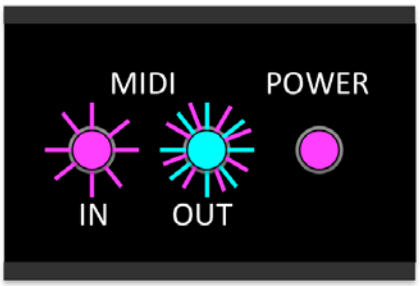
Disconnect Bad Power Supply



Receiving LED Control data



Typical LED State While Playing



1.9.4 Table of all Devices & Parts

DEVICES & PARTS FOR STANDARD SUB-ASSEMBLIES

TYPE OF ITEM	NUM.	DESCRIPTION	SUB ASSEMBLY INCLLUDES / NOTES
SUB ASSEMBLY	00	Preferred Stand, Boom & Light Assembly	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15a-d,
Loose Part	1	APEX 48 STAND	(Recommended & Supplied in Sub-Assemblies)
Loose Part	2	APEX STAND SOFT CASE	(Recommended & Supplied in Sub-Assemblies)
Loose Part	3	13" TRIBAR ARMS (std)	(Optional Accessory)
Loose Part	4	18" TRIBAR ARMS MODIFIED FOR SPACEHARP	(Supplied with all SpaceHarp Controllers)
Loose Part	5	APEX SUPER CLAMPS	(Recommended & Supplied in Sub-Assemblies)
Loose Part	6	APEX adapter plate	(Recommended & Supplied in Sub-Assemblies)
Loose Part	7	Pro Mic Boom	(Recommended & Supplied in Sub-Assemblies)
Loose Part	8	Cable Clips	((Recommended & Supplied in Sub-Assemblies)
Loose Part	9	quick lock mic adapter (two parts)	(Recommended & Supplied in Sub-Assemblies)
Loose Part	10	PAR-16 LIGHT w BULB and CABLE/dimmer	(Supplied with all SpaceHarp Controllers)
Loose Part	11	Pro Mic Boom Soft Carry Case	(Recommended & Supplied in Sub-Assemblies)
Loose Part	12	SpaceHarp Foam Mounting Wedge	(Supplied with all SpaceHarp Controllers)
Loose Part	13	15-25 lb. Sandbag	(Recommended & Supplied in Sub-Assemblies)
SUB ASSEMBLY	14	Sensor Light, Mic Boom, quick lock	6, 7, 8, 9, 10,11, 15a, 15b, 15c, 15d
Loose Part	15	GEL FILTERS	(Supplied with all SpaceHarp Controllers)
Loose Part	15a	30% ND gel	(Supplied with all SpaceHarp Controllers)
Loose Part	15b	60% ND gel	(Supplied with all SpaceHarp Controllers)
Loose Part	15c	Deep Blue gel	(Supplied with all SpaceHarp Controllers)
Loose Part	15d	Deep Purple gel	(Supplied with all SpaceHarp Controllers)
SUB ASSEMBLY	16	SpaceHarp PEDAL BOARD	16a 16b, 16c, 16d, 16e, 17
Loose Part	16a	Gator T-Bone Pedal Board (board only)	(Recommended & Supplied in Sub-Assemblies)
Loose Part	16b	M-Audio SP-2 Sustain Pedal	(Recommended & Supplied in Sub-Assemblies))
Loose Part	16c	M-Audio EX-P Expression Pedals (2)	(Recommended & Supplied in Sub-Assemblies)
Loose Part	16d	Boss FS-5U Momentary Switches (3)	(Recommended & Supplied in Sub-Assemblies)
Loose Part	16e	1/4" Cables with Color-Coding & Cable Wrap	(Recommended & Supplied in Sub-Assemblies)
Loose Part	17	PEDALBOARD SOFT CASE	(Recommended & Supplied in Sub-Assemblies)

DEVICES & PARTS FOR TURN-KEY SYSTEMS *(See Music Performance Systems User Guide)*

TYPE OF ITEM	NUM.	DESCRIPTION	SUB ASSEMBLY INCLLUDES / NOTES
SUB ASSEMBLY	18	4U RACK ASSEMBLY	30, 32, 33, 35, 36, 37, 38, 39
RACK DEVICE	30	Digital Audio Mobile Interface (PreSonus)	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	31	Digital Audio Studio 8x8 Interface (PreSonus)	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	32	WiFi Router	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	33	2x2 USB MIDI Interface	(Recommended & Supplied in Turn-Key Systems)
Loose Part	34	1x1 MIO USB Interface	(Optional Accessory)
RACK DEVICE	35	THUNDERBOLT DOCK	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	36	4U Gator 19" Rack Case	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	37	AC POWER CONDITIONER	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	38	4-HEADPHONE DA (rack)	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	39	1U Rack Shelf	(Recommended & Supplied in Turn-Key Systems)

(Table Continued from previous page)

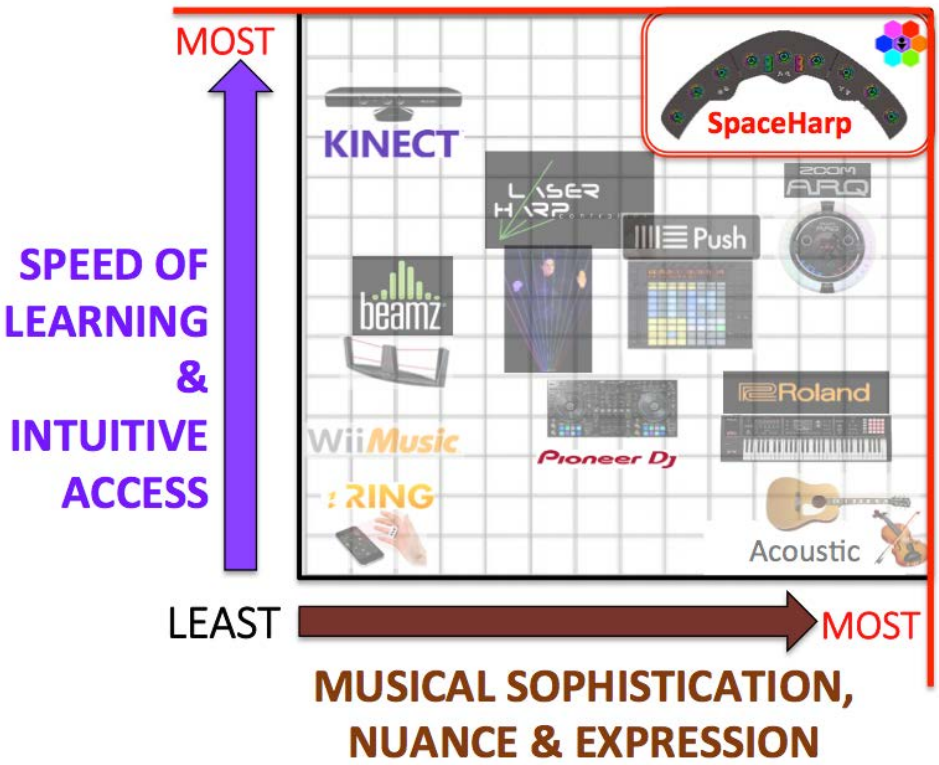
Type of Item	NUM.	DESCRIPTION	SUB ASSEMBLY INCLLUDES / NOTES
Loose Part	19	DAW Laptop Computer (MacBook Pro)	(Recommended & Supplied in Turn-Key Systems)
Loose Part	20	9-ft Laptop combined Power and Thunderbolt Cable	(Recommended & Supplied in Turn-Key Systems)
Loose Part	21	External HD Monitor	(Optional Accessory)
Loose Part	22	POWERED SPEAKERS (2)	(Recommended & Supplied in Turn-Key Systems)
Loose Part	23	Wireless Mouse	(Optional Accessory)
Loose Part	24	iPad tablet	(Optional Accessory)
Loose Part	25	iPad mini tablet	(Optional Accessory)
Loose Part	26	HandSonic HPD-15	(Optional Accessory)
Loose Part	27	Hand-held Microphone	(Optional Accessory)
Loose Part	28	Stereo Headphones (wired)	(Optional Accessory)
Loose Part	29	Wireless Microphone System (2 parts: base/headset)	(Optional Accessory)
SUB ASSEMBLY	40	All cables, referred to collectively	(as required per Configuration)
CABLES	40a	Thunderbolt Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40b	TRS Audio Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40c	unbalanced audio Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40d	MIDI (two - to SpaceHarp & to HPD-15)	(Recommended & Supplied in Turn-Key Systems)
CABLES	40e	Edison Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40f	AC Extension Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40g	Microphone XLR Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40h	Firewire Cable (400)	(Recommended & Supplied in Turn-Key Systems)
CABLES	40i	USB 2.0 Cable	(Recommended & Supplied in Turn-Key Systems)
CABLES	40j	THUNDERBOLT ADAPTER Ethernet	(Recommended & Supplied in Turn-Key Systems)
CABLES	40k	THUNDERBOLT ADAPTER Firewire	(Recommended & Supplied in Turn-Key Systems)
SUB ASSEMBLY	41	6U RACK ASSEMBLY	31, 32, 33, 35, 37, 38, 39, 42, 43, 44, 45
RACK DEVICE	42	6U Gator 19" Road Rack Case	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	43	8x8 MIDI Interface (for 6U RACK)	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	44	4-port Ethernet Gigabit Switch	(Recommended & Supplied in Turn-Key Systems)
RACK DEVICE	45	1U Rack Plate	(Recommended & Supplied in Turn-Key Systems)
Loose Part	46	Hot Hand USB Ring	(Optional Accessory)
Loose Part	47	Hot Hand USB Dongle	(Optional Accessory)
Loose Part	48	iPod / iPhone	(Optional Accessory)
Loose Part	49	Android Remotes	(Optional Accessory)
Loose Part	50	Rolling Flight Case for 1 SpaceHarp	(Optional Accessory)
Loose Part	51	Hard-shell carry case for 1 or 2 SpaceHarps	(Optional Accessory)
Loose Part	52	UNIVERSAL SPEAKER STANDS	(Optional Accessory)
Loose Part	53	LAPTOP STAND (for mic stand)	(Optional Accessory)
Loose Part	54	Tablet microphone mount	(Recommended & Supplied in Turn-Key Systems)
Loose Part	55	X_STAND ALTERNATIVE (???)	(Optional Accessory)
Loose Part	56	EXTERNAL DMX LIGHTING COMPUTER	(Optional Accessory)
Loose Part	57	EXTERNAL LASER CONTROL COMPUTER	(Optional Accessory)
Loose Part	58	EXTERNAL VIDEO CONTROL/VISUALIZER COMPUTER	(Optional Accessory)
Loose Part	59	WIRELESS BLUETOOTH HEADPHONES	(Optional Accessory)
Loose Part	60	Mic stand (for Light Boom)	(Optional Accessory)
Loose Part	61	C-Stand (for Light)	(Optional Accessory)

1.10 BENEFITS

The **SpaceHarp Touchless Motion Music Controller** establishes a new class of modern digital musical instrument. By using the SpaceHarp controller, players balance radical ease of use and rapid learnability with profound musical expressiveness and sonic richness.

- SpaceHarp senses your motion in empty space in a new way;
- Simply moving hands, arms, head or body over it produces musical notes fully under player's control;
- Moving higher or lower above it adds expression and nuance, effortlessly;
- Anyone who can move, can play;
- Instant gratification and mistake-free;
- Creative and fun: many players say, "instantly addictive;"
- Freedom to move continuously in a large space (cubic meters);
- Mistake-free, yet precise and expressive;
- Fully repeatable: there are no random responses;
- Color-changing LEDs provide clear visual feedback before, during and after players' musical event-triggering actions.

The SpaceHarp controller combined with Sound Galaxy provides an ideal solution to many "Pain Points" experienced both by aspiring musicians and professional musicians. SpaceHarp occupies a unique performance advantage compared to other commonly available music controllers and software: it is simultaneously intuitive to play and fast to learn while providing full musical sophistication with nuance and expression:



The SpaceHarp motion sensors operate by means of an IR/visible shadow transition. **Why?**

In terms of the geometry or architecture of "triggering" events, this amounts to having narrow "trigger rays" between each sensor and an overhead point-source flood light fixture: literally, a "harp in space" having "strings" that you move *through.* This kind of sensing setup is also sometimes known as a "through-beam architecture," however in our case the single flood light overhead also produces a player's shadow. (Only a single point source can produce a clean shadow.) Also, this doesn't require painstaking alignments between separate source emitters and each sensor, thus making it much easier to setup; (you just roughly aim the one light over the whole controller).

When you see your visible shadow, from your body (or any prop) covering over a sensor, this simply means that you are intercepting the "virtual trigger ray" that connects that sensor to the overhead IR light. While the sensors respond to near-IR only, our source has some visible also to serve as a visual aid to the player.

This is a unique and powerfully fast and precise type of triggering for music in free-space. It's far more responsive, intuitive, "musical" and better for note polyphony, than are reflective ranging sensor types - which we have tested and rejected over the years. Reflective sensors are great for distance sensing, however when used for Polyphonic Note attacks tend to result in many errors (both false positive triggers and missed triggers) and overall, they just feel "mushy." The problem with using only ranging sensors is trying to combine something like notes triggers together with distance, for effects and notes velocity. In our patented approach, we combine two completely different kinds of sensors, IR shadow optical (for Note triggers) and sonar (ultrasonic) distance ranging (for velocity and effects). Together, these yield a completely "clean" and "tight" feel for music.