SEVEN WOODS AUDIO, Inc.

Concepts, Products, and Circuits for Audio • Analog / Digital

Owner's Guide

Ursa Major
Space Station SST-206
Reverberation and Effects

Revision 1.0
June 2003

Acknowledgements

Special thanks to my wife Jocelyn and daughter Kate for their encouragement and support during days of working late into the night.

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For software design review, thanks to Primus Mutasingwa, Dave Tweed, and engineers at the Motorola DSP help desk. Thanks also to Ron Genereux.

Special thanks to the original Ursa Major team members who shared this absorbing adventure for over eight years.

And finally, thanks to all the users of Ursa Major equipment for their appreciation of and loyalty to the products of “that plucky little company from Belmont, Massachusetts—Ursa Major.”

IMPORTANT NOTICE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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1. Getting started

1.1 Unpacking

As soon as you receive the carton containing your Space Station SST-206, inspect it carefully for signs of shipping damage. Then open the carton and check the unit for damage. Report any shipping damage to the carrier immediately, and file a claim. Although in most cases we insure our shipments, it is the consignee's responsibility to initiate a claim for shipping damage. Save the carton and all packing material in case return to the factory is ever necessary.

1.2 Power

The Space Station operates on 90-260VAC, 50/60Hz and requires no user intervention to be used at these voltages. Plug the line cord into the power supply and the line cord plug into an AC mains source. The unit will turn on. There is no on/off switch.

1.3 Installation

You can either place the SST-206 on a table or console surface, or hold it in your hand. A rubber pad on the bottom surface will help prevent the unit from slipping.

1.4 InpTut and output connections

The input of the Space Station is a 3-pin female XLR connector (cable mounted), with pin 1ground, pin 3 high, and pin 2 low. The input is balanced and terminates the line in 110 ohms. It carries stereo digital audio according to the AES/EBU standard.

The output is a 3-pin male XLR connector (cable mounted), with pin 1ground, pin 3 high, and pin 2 low. The output is balanced and has a source impedance of 110 ohms. It carries stereo digital audio according to the AES/EBU standard.

1.5 Connecting to the mixing console

There are two ways of using the SST-206.

1.5.1 Effects send bus / effect return

In the most common situation, the unit is sent a submix of tracks via a console effect send bus, synthesizes reverberation for that submix, and returns only the reverberation to the console effect return input. The ***dry level*** control is set to zero, since the dry source is mixed in the console.

1.5.2 Series connection

In some situations, you may want to pass a signal to the SST-206 and have it retain the dry signal as well as add reverberation to it. In this case, the ***dry level*** control might be set to near maximum, while the mixing controls for the reverberation or special effects are set to achieve the desired degree of “wetness.”

2. Controls, parameters, and displays common to all programs

2.1 input level

The ***input level*** control adjusts the gain from the digital source to the algorithm inputs so that the source level can be reduced for those cases where the decay time is high and signal builds up within the reverberator. Changes to this control don't upset the mixing ratios.

2.2 Level display

A four LED peak level indicator shows signal levels at 0 (overload), -6, -15, and -30dB and is a true peak sense-and-hold-circuit. Normal operation results in frequent lighting of the green -15 LED, and occasional lighting of the yellow -6 LED, and no flashes of the red 0 LED. The indicator examines the signal level at selected nodes in the reverberation algorithm, catching signal peaks as brief as one sample time (21uS typically) and holding them for about l00ms. Furthermore, the signal levels of all DSP multiplier-accumulator operations at all internal algorithm nodes are monitored and if saturation occurs,

the four LEDs turn on. Effectively, if you operate so that the 0dB LED never flashes, there will be no internal clipping.

2.3 Decay time, lf decay and hf decay

All programs in the SST-206 incorporate a feedback (or recirculation) technique to extend the time span of the effect. Turning the ***decay time*** varies the decay time from a minimum value related to basic delay paths from input to output, to a maximum of several minutes.

Equalizers are placed in the algorithms so that high and/or low frequencies applied to the processor from the source, or from feedback, can be attenuated to modify the decay time at low and high frequencies. This helps you achieve the optimum decay time for different kinds of spaces, such as rooms with more absorbent walls or rooms with higher bass absorption. The two equalizer controls, ***hf decay*** and ***lf decay***, act on any signal going into the reverberator (but not on the source signal mixed to the output by the ***dry level*** control). With zero ***decay time*** setting, no signals are fed-back and any sound going into and through the Digital Processor is simply equalized once, but with feedback each successive pass through the unit is re-equalized.

3. Special features, controls, and parameters of the Space Station Programs SST reverb and SST echo

3.1 Audition delay mixer

The Delay Processor has one input, fed from a mixer where direct and fed-back signals are combined, but it has many outputs, or taps. Eight of these taps are called Audition Delay Taps because their sole function is for mixing into the final signal that is returned to the console. These eight taps are never recirculated and have no role in reverberation or echo feedback effects: thus they can be adjusted independently from any feedback adjustments. The eight taps are paired, and each pair (1 & 2, 3 & 4, etc.) is returned to the output mixer. The odd number taps are mixed together and sent to the left output channel, while the even number taps go to the right output channel. In addition, the dry signal is fed to the dry level pot, which adjusts the level of the signal appearing in the L and R mixes. (The dry signal goes to both L and R mixers, panned center, in effect.) By balancing the relative setting of the ***dry level*** control and the four Audition delay mixer controls (***1 & 2***, ***3 & 4***, ***5 & 6***, ***7 & 8***), you can obtain any ratio from completely dry to completely "wet".

3.2 Audition Delay Patterns

The Audition Delay Taps are set to various time delays by the ***audition delay pattern*** control. The patterns are arranged into families, including rooms, combs, delay clusters, and space repeats. Within each family, there are three to five patterns similar in effect and application. In virtually all patterns, the lower number taps have the shorter delay times, and the times increase progressively from Taps 1 to 8. There is always a delay differential between odd and even taps of a given pair, sometimes left shorter, sometimes right shorter. These differentials and the exact times have been carefully chosen to yield the best sounds and most powerful effects. Altogether, this control gives instant access to 16 patterns.

3.2.1 rooms 1, 2, 3, & 4

These four patterns use semi-randomly chosen delays spaced to sound like the early reflections of rooms. The maximum delay time in each pattern appears at the last taps, 7 and 8, and ranges from about 70ms in room 1 to 255ms in room 4. In the smaller rooms, the taps are closely spaced so that when all are auditioned equally, the gaps are filled in well and no disturbing echo is heard, as would occur with a single tap at the longest delay time. Like all the Audition Delay Patterns, rooms can also be used without feedback to modify sounds by simply adding pure delay, or multiple delays. This is a good set of patterns for general enhancement, or for creating multiple, abrupt-ending echoes. Mix all four tap pairs at the same level in rooms 1 and 2, but feel free to taper the longer delays down in level when in Rooms 3 and 4 to reduce discrete echoes.

3.2.2 combs 6, 10, 22, and 38

The four Comb patterns are for special effect signal modification by non-recursive (no feedback) comb filtering. Comb filters are created when a signal and one or more delayed versions of itself are combined. The result is called a comb because there are periodic nulls and peaks spread across the spectrum, placed at frequencies related to the reciprocal of the delay time. Because the delay times and

tap gains are precise in the Space Station, the nulls produced are very deep; and, because there are four taps plus the dry signal to combine for each output channel, the complexity of the resultant sound is much greater than with traditional DDL's (digital delay lines). Furthermore, the left and right delays are interlaced so that they may be externally summed to yield combs of closer spacing and still more complex and varied sound. And when the SST echo program is used to create fed-back comb effects also, these can be auditioned through one of the Comb patterns to make things even more interesting. Comb filters make good sci -fi machine-like voices, or tune percussive sounds, or place a sharp bite and edge on instruments such as guitars and harps. Mix all four tap pairs at the same level to optimize the effect.

3.2.3 delay clusters fatty, cloud, slap 1, slap 2, and echo

As with other aspects of the Space Station, these effects are so new, we had to invent names for them. This family of patterns uses delay taps spaced closely together, in clusters on the time axis. The clusters occur at progressively later times as you move from fatty to echo. Fatty, with all its taps placed under about 40ms, has no audible separation from the source, but is an excellent loudness enhancing effect that's great with almost any source. Comb filtering isn't a problem with these patterns due to the choice of random times; moreover, the 7kHz frequency response reduces any tendency to comb at higher frequencies. In cloud, the cluster is later, almost with a gap, while slap 1and slap 2 are delayed enough to be heard as real slap echo–except, of course, with eight delay taps for greater fatness and loudness intensification. Echo produces a single repeat of the source at about 250ms, again with eight delays for more punch. Mix all four tap pairs at the same level to optimize the effect.

3.2.4 space repeats 2, 3, and 4

These three patterns provide for 2, 3, or 4 repetitions of a sound, with even spacing in time from 0 to 255ms, and with L-R, L-center-R, or L-R-L-R motion, respectively. All eight taps are used, even with the two-repeat pattern to provide extra punch at each hit. Space Repeats are excellent with percussive sound or sharp transients, since these tend to reveal the spatial movement of time and syncopation best. Of course, Space Repeats may be used with any echo or reverberant effect to cause the decaying signal to ricochet in stereo space as it dies out. Mix all four tap pairs at the same level to optimize the effect.

3.3 *decay time* control

The Space Station uses special dedicated taps just for fed-back effects such as reverb, echo, or resonance. These signals are not accessible for auditioning directly, but their effect is heard when they are fed back to the input mixer and revealed by the Audition Taps. Recirculating these taps creates effects from smooth reverberation with decay times from 0 to 3.5 seconds, to long, repeating echoes lasting over eight seconds, to resonance effects of very short duration but high-Q filter spectral characteristics. For reverberation, a large number of specially randomized taps are summed and equalized before being fed-back via the ***decay time*** control. Echo requires only a single tap for feedback, and this tap is selected for feedback when the SST echo program has been selected. Use the ***echo delay*** control to set the time delay of the echo tap. The SST reverb setting of the ***program*** control selects the randomized and summed feedback taps, which contribute to the rich, high density reverb sound.

Regardless of the program chosen (SST echo or SST reverb), the ***decay time*** control determines the decay time continuously from zero to a maximum (depending on the ***echo delay*** time, upon the EQ settings, and the spectral nature of the source material).

4. Using the Space Station Programs SST reverb and SST echo

The Space Station is capable of a range of effects so broad that the best that can be done in a manual is to indicate the basic types and explain the controls and range of settings pertinent to them. The three basic effects are Pure Delay (no feedback), Reverb, and Echo. Within each of these basic types, the variation in sound modification can be so great as to produce completely different subjective effects, but the operating principles are the same.

4.1 Pure delay effects

In this family of effects, we are simply adding delayed versions of the input signal to itself. We have choice over the time delay settings, the number of discrete delayed versions added, and the relative amplitude of the delay signals and the source. We can also equalize the delayed signals (as a group, not individually) using ***lf decay*** and ***hf decay***. Much of what is said here about mixing the Audition Taps, and the characteristics of the various Audition Delay Patterns, is common to all effects, and can be referred to later. Just remember that the Audition settings determine the way we hear the contents of the memory, while the ***decay time*** control determines the decay of the signal in memory with time.

The Audition Delay Taps are set to times from as short as 6ms to as long as 255 ms. The delay times used in each pattern of a particular family increase, in general, from left to right. Thus in room 1, Taps I&2 have the shortest delay times and 7 & 8 the longest; and in room 4 the delay times are still the shortest at Taps 1 & 2, but all eight time delays are longer than the corresponding times of room 1, 2, or 3. This distribution of delay times within the taps and families is also true in Combs and Delay Clusters. In the Space Repeat family, the delay times range from about 64 ms to 256 ms in each pattern, but are chosen to repeat the source evenly in time and space and do not increase from Tap 1 through Tap 8 in a simple manner.

Rooms can be used as pure delay patterns for doubling when a semi random spread of delay times is desired. The larger Rooms, 3 and 4, have long enough time delays to disturb intelligibility when used with vocals, but will be fine with other sources such as harp, piano, guitar, synthesizer, etc., where the later discrete delays can provide an interesting syncopation, beat fill-in, or spatial shift. Attenuate the longer taps more than the early ones for a more natural sound with the reverb patterns, and for greater intelligibility with vocals. Try using greatest gain with the longest Taps in Room 4, and progressively less gain down to Taps 1 & 2, to get an effect like backwards tape–pseudo time-reversal.

Combs are special effect delay patterns that evenly space the four delay times in each channel at a constant time delay (6, 10, 22, and 38mS apart). Mix all taps together at equal level to get the deepest nulls and sharpest peaks in these Comb filter patterns. The effect of the Comb filters is most audible on sources with a broad spectral content, such as percussion instruments, transients, noise, spoken voice, etc. Like flanging, Comb filtering tends to get lost on pure, single-line voices or instruments.

Delay Clusters are primarily for doubling, slap, and echo effects. All these effects can be done with one or two taps chosen from the Room patterns, but with the Delay Cluster patterns, all eight taps are bunched so close together that the sound is perceived as a new, fatter, louder event, stretched out and with added body.

Fatty places all the delays below the Haas fusion limit so that no separation is heard from the original source, but the sound is perceived as louder and richer. Careful selection of delay times minimizes comb filter effects in these closely spaced clusters, so that they may even be used with vocals.

In Cloud, the cluster is a little more delayed, so that the time delay is just audible with transients, but not with more fluid sources.

Space Repeats are a special family of three patterns which give even repetitions of the source 2, 3, or 4 times, all between zero and 255 ms time delay. If all eight taps are mixed together at equal level, a spatial bouncing occurs due to time delay (not amplitude) difference using the Haas effect. In Space Repeat 2, the dry signal will appear panned center, the first repeat left, and the second repeat right. In Space Repeat 3, the movement would be center, left, right, left; while in Space Repeat 4 the movement is center, left, right, left, and right. Use Space Repeats with percussive sounds, plucked instruments, and transients.

4.2 SST reverb program for reverberation

Natural room-like reverberation calls for auditioning via one of the room patterns to achieve a smooth, random pattern of early arrivals and reverberant decay. For Rooms 3 and 4, be sure to use progressively less gain at the later taps. This reduces the confusion that would result from long, late-arriving reflections. For the largest room, set the ***decay time*** control fully clockwise. The ***lf decay*** and ***hf decay*** controls may be used to shorten the high frequency decay time, as in cathedrals or rooms with absorbent walls, while the low frequency decay time can be shortened to simulate hard-walled rooms, plate reverberators, etc. Small rooms call for a choice of Room l or 2 and a lower setting of the ***decay time*** control. Tiny rooms can be created with Cloud or Fatty and low settings of the ***decay time*** control.

For special effect reverberation, try the Comb Audition Delay Patterns: although the same reverberant process is going on in the Digital Processor, listening to it with comb filter ears results in a completely new and different form of reverberation. Other unique forms of reverb result from auditioning with a Delay Cluster pattern, such as Slap 2 or Echo.

4.3 SST echo program for reverberation

While not strictly reverberation (so called "hard-reverb", as created with few taps), an interesting reverberant effect can be attained using the SST echo program and a 255ms ***echo delay*** setting. With the ***decay time*** control at full clockwise, this will yield a very long decay time, and will sound surprisingly smooth if auditioned through Room 4 or Space Repeat 4. Use it for special cases where the longest decay time is needed. Rolling off both ***lf decay*** and ***hf decay*** results in a progressively telephone-like quality as the sound decays.

4.4 SST echo program for special effects

Here the term "echo" really describes a mode of operation that results from feeding back only one tap, not from the perception of a decaying "hello, hello, hello...." kind of echo (although that can be created, too). This family of effects includes feedback of short time delays that give resonant filter frequency responses with high Q factors. Delay times less than about 30 ms result in filters as opposed to echo effects, and a smooth transition occurs from one to the other as the ***echo delay*** control is advanced from about 20 ms to 255 ms. The SST echo program provides an interesting example of the interplay of feedback and audition parameters.

Consider feedback of the single Echo tap set to less than 30 mS delay time. This results in a cardboard tube filter effect beginning almost immediately after the dry signal enters memory .If this is auditioned with the later Delay Cluster or with the Space Repeats patterns, there will be a delay long enough to produce an echo: there's a delay and then the cardboard tube effect is heard (once, fattened in echo; 2, 3, or 4 times in Space Repeats).

The inverse occurs if a long delay time is set on the Echo tap and fed back, and then auditioned by a Comb pattern. The Comb pattern produces a comb filter using very short Audition Delay Taps, whereas the single, long, fed-back delay produces the discrete decaying echoes, each of which is heard through the comb filter.

5. Room reverberation program

This program is new and was not part of the Space Station SST-282. Room makes much heavier demands upon the DSP chip than does either of the SST programs. In contrast to the SST reverb program, room provides:

- Stereo input to the reverb algorithm so that left and right sources initially appear in true stereo
- Absence of time modulation of delays and the attendant pitch shift and noise
- Flat frequency response to 22kHz unless altered with the ***lf decay*** and ***hf decay*** controls
- Adjustable size
- Maximum decay time several minutes
- 24 bit I/O and processing
- Independent pre delay control
- Early reflections can be suppressed if desired
- Early reflections can be delayed and their pattern extended

In the discussion below, we will not repeat information about controls that are common to all programs. Refer to paragraph 2, above. The labels above the controls indicate whether a control is common to both programs or is different between the SST programs (upper label) and the room program (lower label).

5.1 rvrb level

This control adjusts the level of the main reverberation processor mixed into the output signal. In the room program, the output is made up of three components–The dry source (***dry level***), the reverberation (***rvrb level***), and the early reflections (***ER level***). See paragraph 1.5 above for notes on the use of the dry signal.

5.2 ER level

The early reflection component consists of a total of ten reflections:

- 3 reflections from left in to left ER out
- 2 reflections from left in to right ER out
- 3 reflections from right in to right ER out
- 2 reflections from right in to left ER out

The ***ER level*** control maintains the relative ratio of level among the individual reflections while varying the overall level. For signals presented monophonically to the SST-206 stereo inputs, the *mono* sum of the left and right ER output components are approximately flat frequency response.

5.3 ER length

The ***ER length*** control stretches the entire pattern of ten early reflections proportionally, from under 10ms to 171ms in length.

5.4 ER delay

The ***ER delay*** control is a pre delay control for the early reflections and introduces a delay adjustable from about 10ms to 171ms.

5.5 pre delay

pre delay delays the source on its way into the reverberator by adding a delay ranging from near zero to 171ms. Pre delay is often used to introduce a time gap during which the reverberator remains silent so that the source can stand out in the clear for awhile

5.6 size

size adjusts the “linear dimensions” of the room over a range of x1/32 to x1. We recommend using the largest room size that is compatible still with the transient nature of the source. Sources such as castanets, snare, or wood block may require a reduction in the ***size*** setting in order to keep the source and reverb temporally fused (free of a gaps that reveal the reverberation’s early arrivals).

5.7 Interplay among ER and reverberation parameters

In a way similar to the SST echo program, room gives you free control to craft spaces both natural and unnatural. You can:

Set a large ***size*** to establish a big space, but set a small ***ER length*** so that the early reflections fatten up the source which is heard in a big space.

Set a small ***size*** to establish a tiny resonant space like an oil drum, but set a large ***ER length*** so that the source echoes around discretely during or even slightly after the reverberation concludes.

5.8 Level build up at large *decay time* settings

As the ***decay time*** setting is raised, the feedback gains in the room program become larger, allowing sound already in the reverberator to linger. New sound entering the reverberator adds to the sound already present and the level piles up. You can see this on the ***level*** display. While we have an internal mechanism that scales the drive level down as ***decay time*** is raised, you may still need to reduce the ***input level*** control to avoid internal DSP saturation. This is more likely to be a problem with sources that play continuously, as opposed to those which are transient in nature. The decay time at maximum setting and largest size is several minutes, so it essentially freezes the incoming sound into a kind of “spectral plasma.”

5.9 Coloration in the reverberation

Just as in nature, where when the size of a space decreases, the number of resonant modes decreases, so too in the room program as ***size*** is reduced. Stick with the largest size that still sounds “right.”

Rolling off the decay time at low and/or high frequencies also reduces the number of modes in the reverberation simulation and should be used sparingly.

6. Specifications in Space Station Programs (Reverb and Echo)

6.1 Delay-only mode (*decay time* set to zero)

Measured from input to output, any single Audition Delay Tap set to maximum.

Frequency Response 20-7kHz, ref. 1kHz at -3dB re 0 LED: +0/-3dB. 20-6kHz, ref. 1kHz at -3dB re 0 LED: +1/-ldB.

Dynamic Range 80dB minimum, 20-20kHz noise bandwidth.

Total Distortion and Noise 0.1% typical, 0.2% max at 1kHz, just below 0dB LED threshold, including quantizing noise.

Preemphasis/Deemphasis none.

Delay Settings 16 patterns of 8 delay tap times, pre-programmed to 1ms resolution over range of 1 to 255ms.

Equalization low frequency EQ: +0 / -l0dB, shelving at 20Hz; high frequency EQ: +0 / -l0dB, shelving at 7kHz

I/O Configuration The left and right inputs are sent to the left and right outputs via the ***dry level*** control in stereo. The left and right inputs are summed before being fed into the reverberator. The reverberator develops a stereo output signal by virtue of its multiple taps.

Measured from input to output, ***dry level*** set to maximum.

The dry signal has full bandwidth to 22kHz and no added quantizing noise.

6.2 SST reverb program

Decay Time Zero to 3.5 sec maximum at 500Hz, 1/3rd octave pink noise, with ***lf decay*** and ***hf decay*** set flat, and Room 4 delay pattern.

7. Specifications for Room (Reverberation) Program

Frequency Response 10-22kHz, reference 1kHz, +0/-1dB.
Dynamic Range 98dB minimum (16 bit source), 120dB or better (24 bit source), 20-20kHz noise bandwidth.
Decay Time 0.2 to greater than 100 seconds
Pre Delay 5 to 171 ms
ER Delay 0 to 171 ms
ER Length 10 to 171ms
ER pattern 10 reflections total, allocated 5 left and 5 right.
Decay Time modification (EQ) HF corner from 2kHz to Fs/2, first order LPF; LF corner fixed at 600HZ and shelf varied from –7dB to 0dB.
I/O Configuration The left and right inputs are sent to the left and right outputs via the dry control in stereo. The left and right inputs are applied in stereo to the reverberator. The reverberator develops a stereo output signal by virtue of its design.

8. General Specifications

Input/Output AES/EBU digital audio, 16 – 24 bits, 48kHz nominal, 44.1kHz; transformer coupled balanced, 110 ohm nominal impedance. Preemphasis, if present in the source channel status bits and source signal, is not detected and is retained in the output signal.
Sampling Rate 48kHz nominal, 44.1kHz. Operation at 32kHz is possible, but not supported (delay and decay times are all proportionally longer than at 48kHz). Operation at 88.2 or 96kHz is possible in the SST reverb and SST echo programs only, but is not supported (delay and decay times are all proportionally shorter than at 48kHz). Operation at 44.1kHz is supported, although delay and decay times are all about 10% greater than at the nominal sampling rate of 48kHz.
DSP Motorola DSP56311 running at 141MHz.
Size hand-held case, 5” W x 6.5” H x 0.6" D (12.7 cm x 16.5 cm x 1.5cm), excluding upward protrusion of knobs.
Shipping Weight approximately 4 lbs. (8.8 kg)
Power 1 watt nominal, 400mW typical. In-line external power supply hard-wired to the breakout cable. Detachable international power cord. External power supply accepts AC mains 90 – 260VAC, 50/60Hz.

Environment 10-40 degrees C operating. 0-70 degrees C storage; RH up to 95% non-condensing.
Breakout cable 13 feet (4 meters) multiconductor flexible wire carries digital input (XLR female), digital output (XLR male), and power to unit.

9. Software revision level

From time to time, Seven Woods Audio may make changes or additions to the program code. To determine the revision level of the software in your machine, do the following–

- Unplug the Space Station power supply.
- Watch the LEDs and plug the power supply in again.
- Count the number of times all the LEDs flash on–this is the software revision level (1, 2, 3, etc.),

10. Maintenance

There is no required routine maintenance. The Space Station does not have a battery or a fuse (well, it has a PTC self-resetting fuse). The wood side pieces are lacquered and do not require oil.

11. Limited warranty

Seven Woods Audio, Inc. warrants each Space Station SST-206 to be free from defects in material and workmanship under normal use and service for three years. This warranty begins on the date of delivery to the purchaser or his authorized agent or carrier. During the warranty period, we will repair, or at our option, replace at no charge, components that prove to be defective, provided the equipment is returned, shipping prepaid, to the factory.

This warranty is null and void under any of the following conditions:

- Abuse, neglect, alteration, or repair by unauthorized personnel.
- Damage caused by improper use, or operation from an incorrect power source.
- Damage caused by accident, act of God, war, or civil insurrection.

Seven Woods Audio, Inc. shall not be responsible for any loss or damage, direct or consequential, resulting from machine failure or the in ability of the product to perform. Seven Woods Audio, Inc. shall not be responsible for any damage or loss during shipment to or from the factory or its designated service facility.

This warranty is in lieu of all other warranties, express or implied, and Seven Woods Audio, Inc. does not assume nor authorize anyone to make any warranty or assume any liability not strictly in accordance with the above.

Seven Woods Audio, Inc. reserves the right to make changes or improvements in the design of the machine without obligation to make such changes or improvements in purchaser's machine.

No equipment may be returned under this warranty without prior authorization from Seven Woods Audio, Inc. Authorized return shipments must be prepaid and should be insured. The machine should be returned carefully packed in the original carton and packing material. If these are not available, new ones may be procured from Seven Woods Audio, Inc.

For your protection and our information, please return the Warranty Registration card to Seven Woods Audio, Inc. when you purchase your Space Station SST-206. If there is no copy of the Warranty Registration card in your unit's shipping carton, please ask Seven Woods Audio, Inc. for one.

12. Repair

Except for minor repairs (knob replacement or simple repairs to the breakout cable), we expect all service to be done at the factory. The PCB is a four layer board with fine pitch traces and repair is delicate. We do not anticipate creating a service manual for this unit.

13. Contact information:

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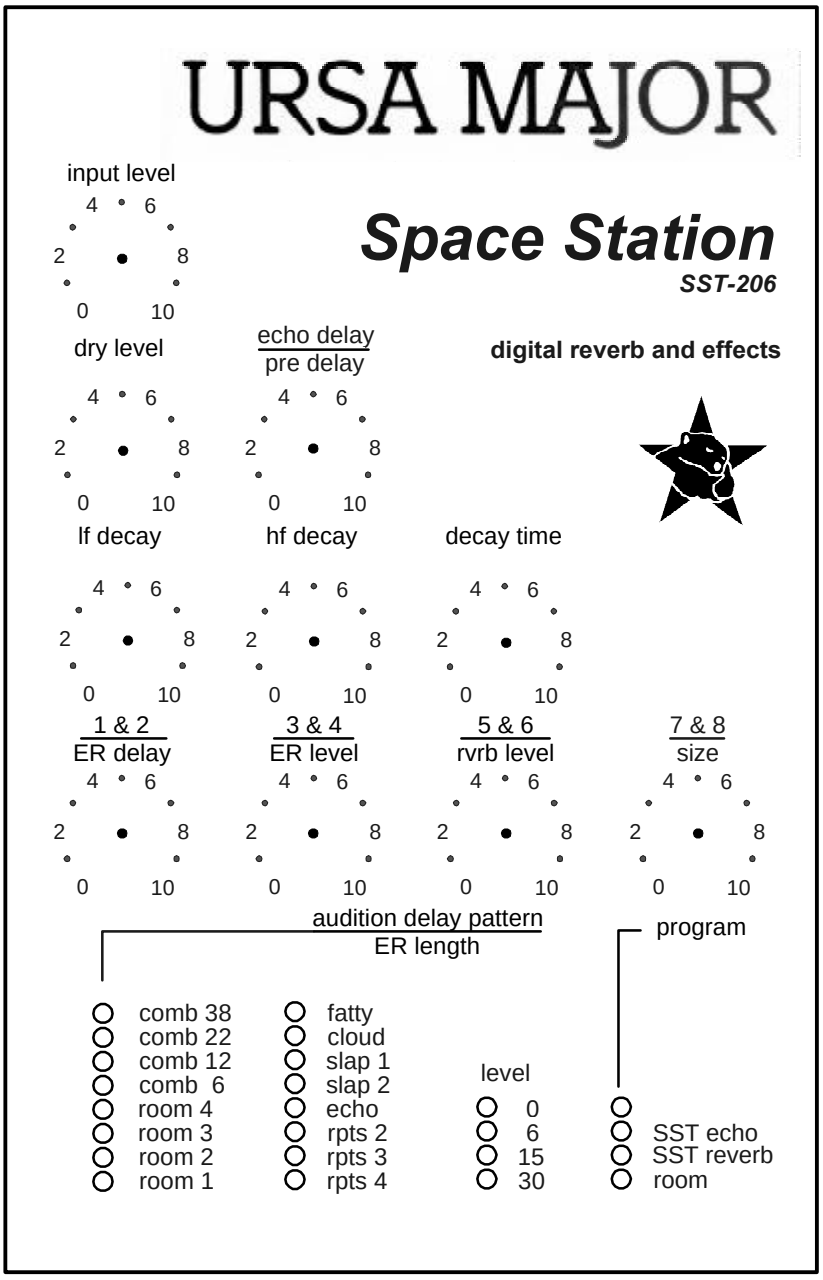

User Setting Sheet, Ursa Major Space Station SST-206

Engineer _____

Artist _____

Date _____

Project _____

Comments _____