

SPACE STATION

SST-282

PRELIMINARY OWNER'S MANUAL



A COMPLETE PROCESSING CENTER FOR —

REVERBERATION Adjustable for initial delay, early reflection pattern, decay time, and decay time at high and low frequencies.

MULTI-TAP DIGITAL DELAY Choose from 16 Audition Delay Programs, then mix the Direct input with any or all of the **eight** Audition Delay Taps in the built-in mixer. There are four basic families of Audition Delay Programs:

Rooms Delay times spread semi-randomly and assigned left and right to simulate early reflections and reverberation build-up in rooms of four different sizes.

Combs Four programs of short, evenly-spaced delays that combine to produce non-recursive comb filters.

Delay Clusters Closely-spaced, randomized delay times, in patterns that don't comb or flange, but yield a new, superior form of doubling, slap, and echo effects.

Space Repeats Three programs of delay times that repeat the input signal evenly in time, and move it in space left-to-right.

FED-BACK DELAY AND ECHO Like tape echo with a single head, only adjustable from 1 to 255ms time delay, and with complete control over EQ and feedback. Audition this feedback pattern with any of the 16 Audition Delay Programs for the ultimate in versatility.

URSA MAJOR

SPACE STATION

DIGITAL DELAY . . . REVERBERATION . . . SPECIAL EFFECTS

Finally, all these are available in one convenient, understandable unit at a price even young studios can afford.

WHAT IT IS AND HOW IT WORKS

The SPACE STATION is an advanced signal processor using time delay techniques to transform a mono source into a new, stereo, output signal. It is as different from earlier delay units as the complex reverberant sound of a room is from a single repeat of a sound slapping off a wall. Where traditional DDL's have only one or two taps, the SPACE STATION has many--eight are used only for listening, and are called Audition Delay Taps, while others are used to synthesize reverberation and echo. The SST-282 can be compared to a special multi-head tape recorder, operating with a loop of tape 255ms long. The tape corresponds to the SST-282's digital memory, and the multiple playback heads to its multiple taps. The eight Audition Delay Taps are placed along this imaginary piece of tape to a resolution of one ms, and can be repositioned at will to any of 16 pre-programmed patterns. You have continuous control over another tap, the Echo tap, which can be set from 1 to 255ms and fed back to the input to create the traditional effects of tape loops. Two programs of Reverberation Tap delay times can be selected as well. Proprietary internal programming randomizes these taps so that they can be stably fed back to produce reverberation. The equalized sum of these taps appears at a pot (Reverb/Echo Feedback) where it can be adjusted to create any decay time from zero to about 3.5 sec.

An important part of the SPACE STATION's fundamental concept is contained in the two groups of delay taps, one for auditioning and the other for reverberation. They operate independently of each other; that is, the Audition Delay Taps set up a way of hearing the contents of the memory, while the Reverberation or Echo Taps, when fed back, determine the kind of reverberant sound existing in the memory. Each acts independently, so that endless varieties of sound can be created. For example, a sound approximating normal room reverberation may be set up by feedback, and then auditioned with any one of the 16 programs to sound like rooms, like a slap, an echo, or even a reverberating comb filter. Or, a comb-like reverberation effect can be set up by feedback, and then auditioned in a room, another comb, or as an echo, slap, etc.

Even more versatility derives from the built-in mixer, where Audition Taps may be mixed in any desired ratio to emphasize earlier reflections, to delay the onset of reverb, etc. The possibilities are many, yet the front panel layout is spacious, uncluttered, and intuitive, due in part to the flow chart screened on the panel above the controls. The control functions were carefully chosen to balance adjustability, with its endless freedom, against pre-programming, with its convenience. For example, consider the advantage of not having to enter eight delay time values for each program, values you either guess or look up somewhere. Then realize that all the EQ, mixing, and feedback functions are self-contained--you don't have to tie up large sections of a console, or untangle a patch-bay.

The SPACE STATION is a new product, not a rehash of old DDL ideas. Take the time to appreciate its differences--they result in a very powerful instrument, with room for a lot of creative discovery. Once you fully grok the SPACE STATION, you'll be amazed it hasn't been done before: it's that sensible and exciting.

SOME TECHNICAL INSIGHTS--BUT NOT TOO MANY

The SPACE STATION was designed by an engineer with a broad knowledge of both analog and digital technologies and the wisdom to choose and successfully use each to its best advantage (but obviously without a hell of a lot of modesty, since he also wrote this brochure). So memory is digital, since with good A-D conversion, noise, distortion, and dynamic range will be excellent with no degradation as a function of delay time. Also, with RAM memory, access is fast and to very fine resolution, permitting many taps and the randomizing algorithm. A-D and D-A were a challenge: how to accomplish at a modest cost the high speed A-D and the many D-A's required each sampling period? A special set of converters had to be designed, proprietary to Ursa Major, that met the speed requirement and permitted a full 80+dB dynamic range and total distortion and noise better than 0.2% at maximum signal level--and with no analog companding.

Perhaps the most arcane and interesting technology in the SPACE STATION is hidden in the techniques used to randomize the reverberation delay taps. A patent disclosure has been filed for this, and we consider it highly proprietary, so little more will be said. But any worker in the field who has ever tried to create reverberation, fed-back delays knows that this is no mean trick.

FEATURES

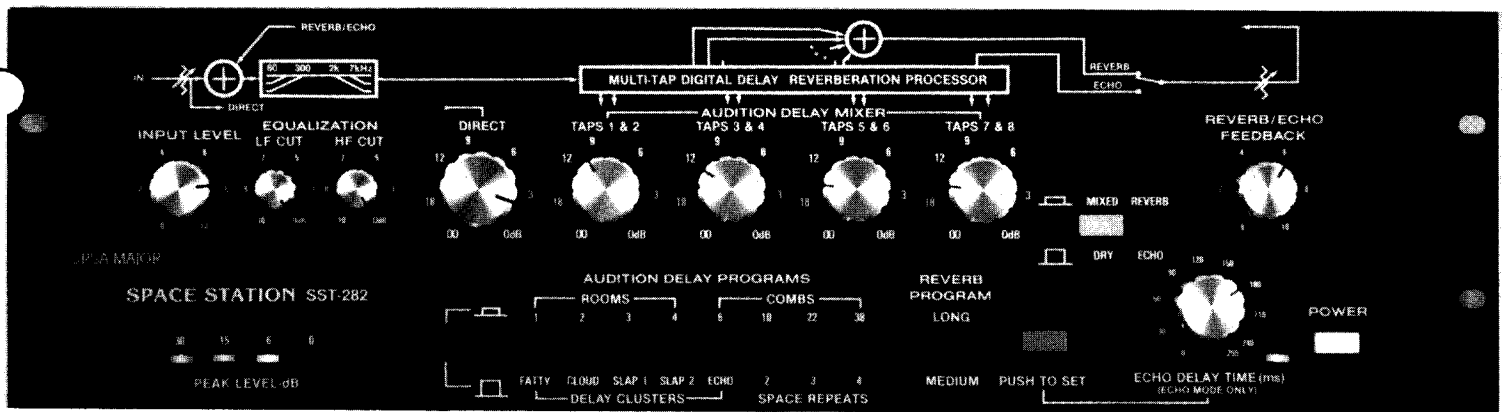
Input Controls The Input Level control adjusts gain so that a wide range of source levels can be connected. Changes in this control don't upset the mixing ratios. A four LED Peak Level indicator shows signal levels at 0 (overload), -6, -15, and -30dB in the digital domain, and is a true peak sense and hold circuit. It permits easy and secure setting of the proper operating level.

Mixer The SPACE STATION has a 9-input/stereo output mixer for the eight Audition Delay Taps and the Direct signal. Taps 1, 3, 5, & 7 are fed to the left summing amplifier, Taps 2, 4, 6, & 8 to the right summer, and Direct to both left and right summers. Using the five mixing controls with reverberation, for example, gives control over the proportion of direct to reverberant sound in the output, and over the amount of early-arriving vs. later-arriving reverberation.

Equalization A simple shelving equalizer is placed in the circuit so that the high and/or low frequencies applied to the processor from the source, or from feed back, can be attenuated to simulate rooms with more absorbent walls, or smaller volumes. It changes the relative decay time at high and low frequencies.

Reverb Program A Medium program provides for normal build-up and smooth decay of reverberation, while the Long program gives a slower build-up and a longer decay time, as in a larger acoustic space. Note that the Reverb/Echo Feedback control provides continuous, fine adjustment of the decay time down to zero with either Reverb Program.

Audition Delay Programs An Audition Delay Program is a set of eight time delay values set into the operating registers from PROM memory to produce the eight Audition Delays needed to create each effect. There are 16 Audition Delay Programs, grouped in four families, with names screened on the panel to aid in their recall.



Rooms 1, 2, 3, & 4 These four programs use semi-randomly chosen delays spaced to sound like the early reflections of rooms. The maximum delay time in each program appears at the last taps, 7&8, and ranges from about 70ms in Room 1 to 255ms in Room 4. The smaller rooms are appropriate for auditioning with the Medium Reverb Program and shorter decay times, while the two larger rooms provide a more spacious sound and would normally be used with the Long Reverb Program and greater feedback. 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 Programs, the Rooms can also be used without feedback to modify sounds by simply adding pure delay, or multiple delays. This is a good set of programs for general purpose doubling and loudness enhancement, or for creating multiple, abrupt-ending echoes.

Combs 6, 10, 22, & 38 The four Comb programs are for special-effect signal modification by 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 Direct signal to combine for each output channel, the complexity of the resultant sound is much greater than with traditional DDL's. 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. As if this wasn't enough, when the Echo mode is used to create fed-back comb effects also, they can be auditioned through one of the Comb programs 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 like guitar or harp.

Delay Clusters--Fatty, Cloud, Slap 1, Slap 2, & Echo As with some other aspects of the SPACE STATION, these are so new we had to invent names for them. This family of programs uses delay taps spaced close 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 programs due to randomized choice of times, plus the 7kHz delay response reduces any tendency to comb at higher frequencies. In Cloud, the cluster is later, almost with a gap, while Slap 1 and Slap 2 are delayed enough to be heard as a 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.

Space Repeats 2, 3, & 4 These three programs 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 program, to provide extra punch at each hit. Space Repeats are dynamite with percussive sound, or sharp transients, since these tend to reveal the spatial movement and time 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.

Echo Mode This mode connects just one delay tap through the Reverb/Echo Feedback control to produce a decaying, repeating echo, as is done with tape. As the Echo Delay Time is reduced, the effect eventually becomes a frequency domain one, a recursive comb filter, whose sharp nulls and peaks vary with the delay setting. The complexity of these echo or fed-back comb effects can be increased by auditioning them with more than one Audition Delay. For example, if a 255ms echo is decaying in memory and is auditioned with the Space Repeat 4 program, the single echo will be heard beginning and continuing four times, for a higher echo density.

HOW THE SPACE STATION CAN WORK FOR YOU

By now, the signal processing uses of the SPACE STATION are, hopefully, clear, or if bewildering, at least also intriguing. But there are other applications. Musicians can use it in performance, where all these effects can be achieved on stage to lend freedom and versatility to a performance. The fact that everything needed is built in to the SPACE STATION, requiring no external mixers or equalizers, makes it easy to set up even complex effects. And the SST-282's convenient panel layout and clear flow chart make it intuitive as well, while its rugged construction and conservative engineering ensure reliable performance on the road.

It's also applicable in sound reinforcement, although not in the well-known role as a synchronizer of remote speakers; instead, it can give a rich mix of delayed and reverberant sounds to enhance acoustically flat environments in small nightclubs, discos, etc. Performances will sound superior when enveloped in the more spacious acoustic ambience the SPACE STATION can create through the existing sound system.

And, if an individual can afford one, it's perhaps the ultimate delay unit for home listening with stereo rear channel ambience signals derived from the front L+R signal. The SST-282's control flexibility is perfect for tailoring the ambience signal to match the varied needs of different program material, and the reverberation is far more natural than that produced by simpler units.

ABOUT REVERB, DELAY, THE SPACE STATION, AND THE EXISTENCE OF FREE LUNCHES

Most studio personnel and musicians have used time delay and reverb, but some occasionally get confused over the difference. The subtleties of this difference are nowhere more clearly felt than in the SPACE STATION, where all shades of effects from pure delay to pure echo, to rich, random reverb are possible. The basic characteristic of time delay is the simultaneous presence of a signal and a delayed version of the same signal. In a room this occurs by virtue of the finite speed of sound and the distance it travels between reflections off walls and other physical features. In effect, the room is a random access memory with feedback, in which many historical versions of the original sound coexist until they die out due to acoustic absorption. The time delay of sound traveling through air and the memory of the room's acoustic volume, coupled with the "feedback" of reflections result in the complex decaying sound we call room reverberation. The path lengths are so many and varied, and the resulting echo pattern so complex, that the simulation of reverberation by purely electronic means is a difficult problem. The SPACE STATION, with its multiplicity of randomized taps, is an effective, reasonably priced approach to the solution to this synthesis problem.

It is said that American Indian craftsmen always left a defect in their handiwork, whether a bead of the wrong color in a bracelet, or a miswoven section of a basket, in order to not encroach upon God's perfection. Well, we at URSA MAJOR aren't acting out of the same piety, but nevertheless have not produced a perfect product (no free lunch). In the reverb mode only, there is some noise that may be heard during very pure solos of voice, flute, or tone. With most program material, it's simply inaudible, and even with demanding sources, it gets lost in the shuffle of the final mix. In the straight delay or echo modes, noise performance is of the highest caliber.

If you have a well-established studio, you already have a good chamber or plate reverb: keep it, and use the SPACE STATION for all its special delay, echo, and reverb effects, and for reverb with shorter decay times (try adjusting a room or plate down to 0.5sec decay time!). If you have a small studio, or are on the road, use the SPACE STATION for all your delay, echo, and reverb effects. The SPACE STATION is a best buy in today's market due to its low price, broad range of effects, and adjustability. There is simply no other unit like it at any price, while other digital reverb units costing 3 to 7 times our price are less versatile. And watch out for any delay unit with 2 or 3 taps fed-back that claims to produce "reverberation." Try a SPACE STATION-- you'll love it.

URSA MAJOR

Ursa Major is a new company, dedicated to producing useful, lasting products of superior value for professional audio users, and to building a satisfying, equitable workplace for its people. To this end, control and ownership of the company will be kept internal, among the work-force, and growth will be financed through loans, strict credit terms, and sweat. We have our heads and hearts in the clouds, and our feet firmly on the ground. By daring to turn our dreams into realities, we strive to grow and prosper.

SPACE STATION

SPECIFICATIONS

Input Active differential input, 10K ohms High pin, 20K ohms Low pin, XLR-3 connector. Sensitivity at 1kHz for 0dB LED is 0dBm minimum.

Outputs Single-ended from op-amp, source resistance 47 ohms, minimum load resistance for +18dBm is 600 ohms, XLR-3 connectors.

Specifications for Delay-Only Mode

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

Frequency Response 20-7kHz, ref. 1kHz at -3dB re 0 LED: +1/-4dB
20-6kHz, ref. 1kHz at -3dB re 0 LED: +1/-1dB

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 programs of 8 delay tap times, pre-programmed to 1ms resolution over range of 1 to 255ms.

Sampling Rate 16kHz nominal.

Specifications for Reverberation Mode

Decay Time Zero to 3.5 sec maximum at 500Hz, 1/3rd octave noise, with HF and LF Equalization set flat, Long reverb program, and Room 4 delay program.

Equalization +0/-10dB, shelving at 20Hz
+0/-10dB, shelving at 7kHz

General Specifications

Size Standard relay rack, 19 x 5-1/4 x 9" (48.3 x 13.9 x 22.9cm), excluding rear protrusion of connectors. Weight approximately 10lbs (4.5kg)

Power 115/230VAC, 50/60Hz, 30 watts nominal. Detachable international power cord. Regulated supplies retain regulation down to 95VAC for international use. 100/200VAC unit available on special order.

Environment 10-40 degrees C operating, 0-70 degrees C storage; RH up to 95% non-condensing.

Limited Warranty Parts and labor are guaranteed under normal use for one year after shipment. Service will be done at the factory for the first year of product life.

Net Professional US Price \$1995, FOB the factory.

In accordance with a policy of product improvement and development we reserve the right to modify or change design or price without prior notice.

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Box 18 Belmont, MA 02178 • Telephone: (617) 489-2039