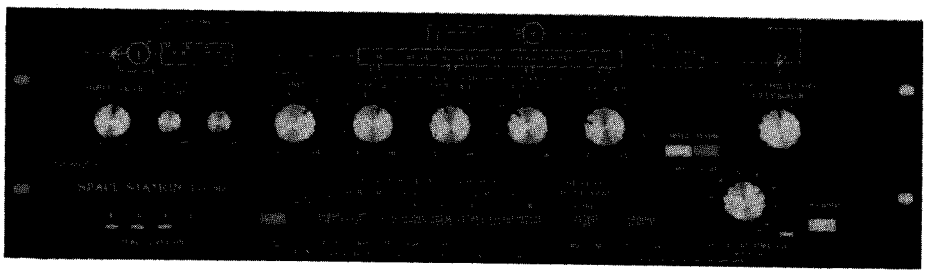
studio sound
AND BROADCAST ENGINEERING



MANUFACTURER'S SPECIFICATION

Input: active differential input, lOkHz high pin, 20kHz low pin, XLR-3 connector. Sensitivity at 1kHz for 0dB LED is OdBm minimum.

Outputs: single-ended from operational amplifier, source resistance 47t2, minimum load resistance for +18dBm is 600f2, XLR-3 connectors.

SPECIFICATIONS FOR DELAY ONLY MODE (measured from input to output, any single audition delay tap).

Frequency response: 20Hz to 7kHz, reference I kHz at -3dB reference 0 LED- +1/-4dB, 20Hz to 6kHz, reference 1 kHz at -3dB reference 0 LED-±1 dB.

Dynamic range: 80dB minimum, 20Hz to 20kHz noise bandwidth.

Total distortion and noise: 0.1% typical, 0.2% maximum at 1kHz, just below 0dB LED threshold, including quantising noise.

Pre-emphasis, de-emphasis: none.

Delay settings: 16 programmes of eight delay tap times, preprogrammed to 1ms resolution over the range of 1ms to 225ms.

Sampling rate: l6kHz nominal.

SPECIFICATIONS FOR REVERBERATION MODE

Decay time: zero to 3.5s maximum at 500Hz, #-octave noise, with HF and LF equalisation set flat, long reverberation programme and four decay programmes.

Equalisation: +0/-10dB shelving at 20Hz. +OdB/-10dB shelving at 7kHz.

GENERAL SPECIFICATIONS

Size: standard 19in x 5.25in x 9in (483 x 139 x 229mm) -rear protrusions for connectors excluded.

Weight: approx 4.5kg.

Power: 115/230V AC for international use. 30W nominal.

Environment: 10°C to 40°C operating. 0°C to 70°C storage; relative humidity up to 95% non-condensing

Price: Z1,260,$1995.

Manufacturer: Ursa Major, Box 18, Belmont, Mass 021'74 USA.

UK: Feldon Audio Ltd,127 Great Portland Street, London W1.

THE Ursa Major *Space Station is* a novel effects unit employing a digital delay line with random access memory and a maximum delay capacity of 255ms. Internal programmed selection of taps, provided every Ims in the delay line, obtain the special effects. In addition to the above taps, by means of a programmable read-only memory, considerable manual control of the effects is provided (see **fig 1).** The electronically balanced input is fed to the input level control, it splits and is fed to an adder where a feedback signal can be applied. It is also fed to a 'dry/mixed' potentiometer which allows the outputs to be ;derived from any mixture of the input 'dry' signal and the processed signal.

The input adder is followed by the HF and LF equalisers and then the A/D converter. After these are four digitally controlled LED level indicators showing maximum peak input level on a red indicator and -6dB, -15dB and -30dB below maximum on a yellow and two green indicators respectively. The signal in digital form is then fed to the delay line which has a number of taps.

In fig 1 at the bottom of the delay line are four pairs of two taps, each known as audition taps. Each pair of audition taps is programme-controlled to produce a stereo output which may be mixed with the 'dry' input signal to produce two outputs in the form of a pseudo stereo output, the four pairs being at progressively longer delays.

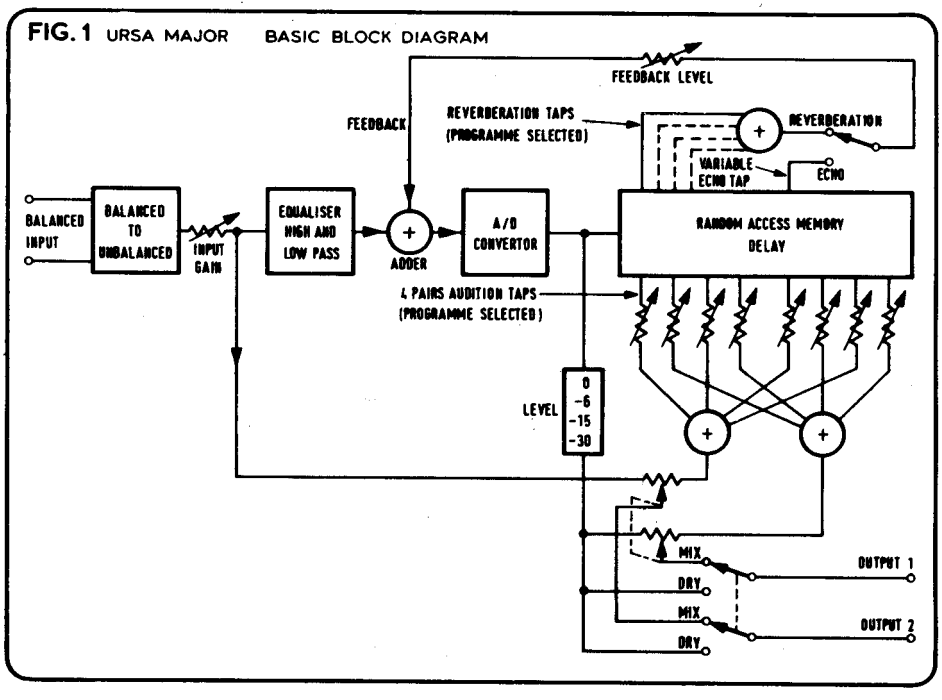
Referring again to fig 1, a number of taps above the delay line can be fed to an adder to produce a reverberation feedback signal which is derived by programme control of the selected delay times. Alternatively the feedback signal may be switched to the echo mode where the time delay of the feedback signal is manually controlled from zero to 255ms maximum. Either of these signals may be fed to the feedback level control and then to manual bass and treble equalisers as high and lowpass filters.

It follows that the output signals are a combination of the individual level settings of the four audition taps which may be mixed with the original 'dry' input signal in any desired proportion, these features controlling the 'sound' of the output, whilst the feedback permutations control the reverberant qualities of the output signal.*

The *Space Station is* designed for mounting into a standard 19in rack and has XLR signal connectors and an IEC mains power connector at the rear. The base is covered with a printed circuit mother board which supports the power supplies and many other components. Two sub-boards plug into the mother board with a further board holding many of the front panel controls which are connected by a ribbon cable connector. Most components are clearly identified for servicing but neither of the fuses are identified in value or type and one is very difficult to get at, as it's underneath the front panel circuit board.

The general standard of layout and construction is excellent with good quality components being used and all of the integrated

"You will note that no mention has been made of the D/A conversion and I'm afraid that I have no information on this aspect of the unit as only preliminary documentation was supplied.



circuits being mounted into sockets to ease servicing.

The dark blue front panel layout is extremely clear. The controls are sensibly grouped, easily identified and include a basic block diagram.

Left of the front panel is the input level control with the peak level indicators below and the equalisation controls for the LF cut and the HF cut to the right. Further to the right is the direct/reverberation mixing potentiometer followed by the four level controls for the outputs of the four pairs of programme selected delay taps. Underneath these are the pushbuttons for selecting the operating programme of which more later.

At the right of the unit is the feedback level potentiometer and the echo delay time potentiometer which operates in conjunction with a red pushbutton: this pushbutton is pressed to set the delay after the delay has been set on the potentiometer thus providing an instant jump in echo delay time. If the button is held pressed the delay time may be constantly varied, but not always without undesirable effects.

Two locking pushbuttons allow selection of the 'dry' input signal alone, irrespective of the setting of the mixing potentiometer and also selection of either the reverberation mode using the added multiple delay taps or the echo mode where the tapping is controlled by the echo delay time setting.

In either mode the audition delay programmes function upon the four sets of audition delay tap outputs in the mix set by the four front panel level controls, 16 such programmes are selected by eight interlocked pushbutton switches. Each of these switches has a dual function depending on the setting of an adjacent locking pushbutton switch which selects the programmes indicated by legends, above or below the interlocking switches. In addition a separate button selects a long or medium reverberation programme, there being a subtle difference between the two.

Considering the top set of legends the first four pushbuttons are identified as 'Rooms 1, 2, 3 and 4' and are intended to simulate the reverberation characteristics of four different sized rooms in terms of early reflections. In these modes the longest audition delay programme taps are about 70ms for the smallest room, and 255ms for the largest with the earlier taps providing appropriately shorter times. Subjectively these effects were found to be different from conventional reverberation units in particular the effects with the large rooms, which were very useful with judicious use of the feedback function. I was not, however, impressed with the simulated stereo output which was irritating with speech.

The next four top buttons comprise four different programmes of comb filters. Remembering that the *Space Station* has four audition delay taps and also that the two outputs have different delays, these comb effects are very comprehensive and very unusual effects can be obtained by combining the comb programmes together with the feedback.

Turning to the bottom set of legends, these are divided into two groups broadly identified as `delay clusters' and 'space repeats'. There are three 'space repeat' programmes which provide two, three or four repeats of the input signal with the repeat sequence being set by the audition delay mixer controls. The use of the space repeat feature in conjunction with feedback can of course produce multiple repeats (or long distance echoes) continuing over several seconds-what may be described as science fiction outer space sounds.

The delay cluster modes have some highly original captions under the switches- 'fatty', 'cloud', 'slap 1', 'slap 2' and 'echo'. All these fancy names result from the use of single repeats with the delay taps close together, the farthest apart being 'echo' which uses the full 250ms delay capability with as usual the eight delay taps available at the output, but delivering a cluster or outputs at similar delay times. The echo was most effective with a degree of feedback, the remaining four modes providing interesting effects on musical instruments either increasing or decreasing apparent loudness and presence.

The one remaining feature is the echo mode with its associated echo delay time manual setting. This provides a single repeat after the selected delay time. when using the latest audition delay mixer taps, repeating at earlier times when using earlier taps. More interesting effects can be produced by combining this feature with space repeats and with feedback thus giving multiple decaying repeats.

If short echo times are selected with feedback, the unit becomes a notch filter, or rather a comb filter with flanging effects available by slight movement of the echo delay control with the `set' button pressed. This button was found to be a rather irritating feature for two reasons, firstly the unit was inadvertently switched off by pressing the nearby power on/off switch, and secondly it was a 2-handed operation-it would be better if the switch and the potentiometer had been a single combined control.

The technical aspects

The electronically balanced input was found to have a 19.7kQ impedance in one leg and a lOkf1 impedance in the other, with the impedance being 20kQ in the balanced mode with a common mode rejection ratio of 50dB throughout the audio frequency range. The input impedance was constant with the input gain setting and the maximum input level +22dBm at any gain setting.

At maximum input gain, the red 0dB overload indicator became illuminated at an input level of OdBm with the yellow -6dB indicator and the green -15dB indicators illuminating at precisely 6dB and 15dB below the red indicator and the -30dB indicator operating at -30.5dBm.

These indicators were found to sense the peak value of the input and to operate extremely fast thus providing an excellent level control for the digital delay which like most digital devices clips on overload.

The overall frequency response of the direct chain was found to be flat within 1dB from 20Hz to 20kHz, the frequency response of the indirect chain is shown in fig 2 with the two equalisation controls at the extreme positions. While the highpass control has an adequately large range it is felt that the lowpass control could do with a wider range in the 5kHz region. Clearly in audio terms the 7kHz bandwidth could be wider to provide more dramatic effects, but that is really of little consequence in an effects unit of this versatility.

As can be seen from fig 3 the second and third harmonic distortion products are virtually equal and at a very low level throughout the frequency range of the delay-furthermore the distortion depended little on the audio signal level.

Similarly as shown in fig 4 the twin tone intermodulation distortion to the CCIF method using tones separated by 70Hz was extremely low for a device of this kind.

Remembering that no pre-emphasis is used the frequency response is flat at all signal levels. The noise performance was also excellent with the following noise levels being measured in both outputs **(Table 1).**

FIG. 2
URSA MAJOR
FREQUENCY RESPONSE
OF INDIRECT CHANNEL

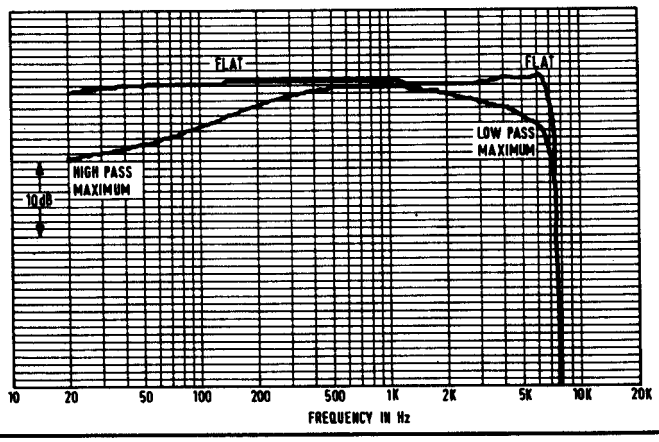


TABLE I

Band limited 22Hz to 22kHz rms	-82dBm
A-weighted rms	-81dBm
CCIR-weighted rms	-71dBm
CCIR-weighted quasi-peak	-65dBm

These noise performance figures should be related to the maximum output capability of greater than + 18dBm from a 48f2 unbalanced source. Furthermore as no compression or other analogue noise reduction is employed, these are genuine dynamic or static perform-

FIG. 3
URSA MAJOR
HARMONIC DISTORTION

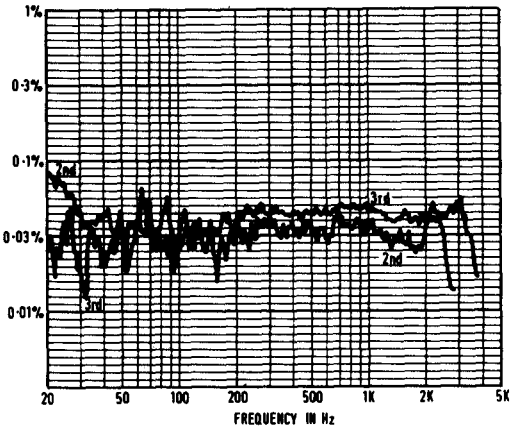


FIG. 4 URSA MAJOR CCIF INTERMODULATION DISTORTION AT −6dB