Oakley Sound Systems

Stereo Ensemble – SRE330

User Manual

V2.0

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Introduction

This is the User Manual for the SRE330 Stereo Ensemble module from Oakley Sound. This document contains an overview of the unit and goes into some detail regarding the operation of the module. It also contains the calibration instructions.

For the Builder's Guide, which contains a basic introduction to the circuit board and a full parts list for the components needed to populate the board, please visit the main project webpage at:

http://www.oakleysound.com/sre330.htm

For general information regarding where to get parts and suggested part numbers please see our useful Parts Guide at the project webpage or http://www.oakleysound.com/parts.pdf.

For general information on how to build our modules, including circuit board population, mounting front panel components and making up board interconnects please see our generic Construction Guide at the project webpage or http://www.oakleysound.com/construct.pdf.

The Oakley Sound SRE330

The Oakley SRE330 is a multi mode stereo ensemble unit designed to mimic the behaviour of the multichannel chorus and ensemble units of late 1970s and early 1980s. The SRE330 uses up to four channels of bucket brigade delay (BBD) lines and up to four voltage controlled low frequency oscillators (LFO) to achieve a sound reminiscent of various types of string machines, guitar chorus pedals and studio rack effects of yesteryear.

Unlike the original devices the SRE330 allows greater control over the modulation depths, speeds and waveforms, as well as featuring a wet/dry control. Input and output level control pots are also provided to allow maximum flexibility in dealing with a variety of input signal levels. Both the stereo input and output connections are balanced but can be used with unbalanced connections if desired.

The unit features classic companding noise reduction circuitry which keeps unwanted noise levels to an acceptable level while also adding a 'vintage' sound of its own. A four LED level meter helps you keep signal levels at optimum ensuring a good noise to signal ratio without clipping.

The SRE330 features two basic types of ensemble, three phase and multimode, which are selected by a front panel switch.

The three phase setting replicates the action of classic string machines originally from Europe such as the Solina and Logan String Melody. Three BBDs are used in this mode and their delay times are controlled by two three phase fixed frequency sine wave oscillators. One of the oscillators, the chorus, runs very slowly. And the other, the vibrato, runs a little faster. However, unlike the majority of classic string machines, the modulation depths of each oscillator can be controlled with the appropriate front panel level pot.

The Multimode setting is designed to replicate the actions of various classic synth chorus units and string machines from Japan. The Multimode setting, as its name implies, has three modes of operation:

1. Quad ensemble. All four delay lines are operating in this mode – with two BBDs and two LFOs being used for each stereo channel. This mode is at its most effective when the wet/dry control is set to around 100% wet.

2. Dual ensemble. In this mode two BBDs are being used, one per stereo channel. Each BBD can be modulated by its own pair of LFOs. This mode is very effective when the wet/dry control is set to around 50%.

3. Stereo Chorus. Again, in this mode, two BBDs are being used. But this time both BBDs are being driven from the same pair of LFOs. However, one of the BBDs will receive the inverted outputs of the VC-LFO pair. Like mode 2, this mode is very effective when the wet/dry control is set to around 50%.

The four LFOs used in the Multimode setting are made from four separate circuits. Two of the LFOs produce sine waves and two of them produce triangle waves. The SRE330 is wired so

that each stereo channel's BBDs are controlled by one set of triangle and sine wave LFOs. Each pair of similar waveform LFOs are controlled by their own speed and depth pots. So one set of pots controls the two sine wave LFOs and one set controls the two triangle wave LFOs. Each pair of similar waveform LFOs will therefore track each other but one is set to always run 20% slower than the other.

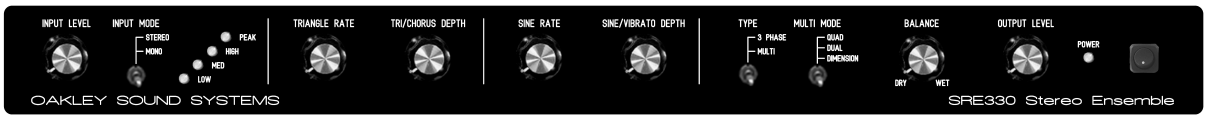
The unit is built into a 1U high full width 19” rack and uses no obsolete parts.

The input and output sockets are high quality Switchcraft 112APCX devices. A relay controlled muting circuit is employed to reduce thumps on the audio outputs when the power supply is switched on and off.

The unit is powered from a Yamaha PA-20 'line lump' type mains adapter.

The SRE330 is an enhanced version of our now legacy SE330 half rack unit.

Operating Instructions



INPUT LEVEL and LED signal meter

The input level controls the signal running through the SRE330. It affects both the wet and dry signals. With the pot fully counter clockwise the signal is completely shut off.

The signal meter shows the audio signal level going to the bucket brigade delay (BBD) circuitry. If the signal is too high then the BBDs will be overdriven and produce significant distortion. If the signal is too low then the inherent noise produced by the BBD circuits will become very noticeable. The aim then is to have as large a signal as possible without introducing too much distortion.

The input level should be set so that the yellow HIGH LED on the signal meter will pulse in time with the input signal. If the red PEAK LED lights up the BBDs will be distorting. However, depending on the signal that is going through the SRE330, overdriving the BBDs for very short intervals may be acceptable. Indeed, sonically this can produce some interesting artefacts. No harm will come to the unit if the unit is run continually in the red.

It should be noted that the input signal is compressed prior to be being sent to the BBDs to reduce the likelihood of overdriving the BBDs and to improve overall signal to noise ratio. The signal meter is monitoring the signal after it has been compressed, so the SRE330's meter will behave slightly differently to normal LED meters such as that found on your audio mixer. Any compressor takes a certain time to react to the input signal so very fast transient signals will cause the higher signal LEDs to light even when the apparent volume is quite low. Since the signal meter monitors the signal going into the BBDs it may be necessary to set the input level lower for, say, drum loops, than for synth pads, to avoid any unwanted distortion.

INPUT MODE (Switch)

The SRE330 is a stereo in – stereo out effects unit. However, sometimes it may be useful to allow the left and right audio inputs to be summed together to mono before sending them to the BBD circuits. Consider, for example, a synth producing a piano type sound which is typically spread across the stereo field with lower notes panned left and higher notes panned right. If the SRE330 were used to add a little stereo chorus to this sound it is effective to have all notes treated equally and let the chorus enhance the stereo imaging. The input mode can then be switched to MONO which removes the stereo information from the input before applying it to the chorus circuitry. The input mode switch does not affect the dry signal which is left as a stereo signal.

The SRE330's stereo inputs can be used with mono sources. Simply connect the jack plug to the right hand input socket and the input signal will be applied automatically to both the left

and right inputs. In this case the INPUT MODE switch will have no effect on the signal since the input signal is already mono.

TYPE (Switch)

This is a two position switch that selects between two distinct modes of operation. The operation of the four modulation controls are also changed by the position of this switch.

3 PHASE

This is a recreation of the classic three phase three stage BBD ensemble effect made famous in a variety of string machines like the Logan String Melody and Solina. The TRIANGLE RATE and SINE RATE modulation controls do not function in this mode.

3 PHASE uses three BBD channels. With a stereo input and input mode switch set to stereo, one BBD channel treats the left hand audio signal and outputs on the left, one treats the right hand audio signal and outputs of the right, and one treats both left and right together and outputs on both left and right equally. This creates a beautiful wide stereo sound even from monophonic input sources. If you want the classic monophonic ensemble sound you will need to do this externally from the SRE330 using your mixing desk. Simply set the mixer's input channel to mono or use two separate input channels and set both pan pots to central.

Each BBD channel produces a delay. This delay is altered in real time by two fixed frequency oscillators producing sine waves. One oscillator runs slowly and the other much faster. The amount of modulation for all three BBD channels is adjusted by the two modulation depth controls on the front panel. Each BBD channel is modulated by the same two oscillators but each channel uses a different phase output from each oscillator. Each of the two oscillators has three outputs, all sine waves and at the same frequency, but each output lagging behind the next one by one third of one complete cycle.

MULTI

This is a recreation of some classic Japanese chorus and ensemble units. All four modulation controls function in this mode. The actual mode of operation is determined by a second switch, MULTI MODE.

MULTI MODE (Switch)

This three position switch selects between the three different modes, quad, dual and stereo (also called Dimension on some panels).

With the SRE330 set to MULTI there are up to four BBD channels in operation. Each side of the stereo signal has two dedicated BBDs and, like in the 3 PHASE mode, each BBD has its own driver circuitry which controls the delay imparted by that BBD. Once again these driver circuits are modulated with low frequency oscillators (LFOs) producing a varying delay from each BBD channel.

In this mode there are four LFOs but they are not simply connected so that one LFO controls its own BBD. This should work well but in practice it doesn't give the sound of the classic Japanese string machines and effects units that we want to hear. So the SRE330 Multi Mode does something much more complicated and, in doing so, can mimic most of the well known ensembles units of the past.

STEREO (DIMENSION) Mode

This is the simplest of the SRE330's three multi modes. Only two BBD lines are used in this mode, one for the left hand channel and one for the right. Each BBD produces a similar delay when not modulated so that the sound from both left and right is more or less the same. Two LFOs, one whose output is a triangle wave, the other, whose output is a sine wave, are used as modulation sources. The rate and depth of each LFO is controllable from the front panel controls. Both BBDs are modulated by the sum of both LFOs. That is, both LFOs control both BBDs together. However, there is one important difference between the modulating signals that are sent to each BBD. The BBD that affects the right hand side operates inversely to the left hand one. So that when the delay of the left hand BBD is increasing, the right hand one is decreasing.

When listened to dry the overall effect is like an odd form of panning and vibrato at the same time. But when the balance pot is turned to around 50% a subtle chorus sound is heard.

DUAL Chorus Mode

This mode is similar to the dimension mode but features four LFOs and not just two. Instead of the right hand BBD being modulated by the inverse of the same LFOs that control the left hand side, this time the right hand BBD gets its own pair of triangle and sine wave LFOs. However, these LFOs are not completely independent of the left hand side ones. The rate and frequency controls are shared with the left hand LFOs. Therefore the right hand side LFOs will track the frequency and amplitude of the left hand side LFOs. The only difference between the two sides are that the right hand side LFOs always run 20% faster than the left hand side. This keeps things relatively stable across the stereo panorama, yet, because of the free running nature of all four LFOs, things are different enough between the channels to give a wide ensemble sound.

QUAD Ensemble Mode

The RS or VP ensemble mode. The third mode is the most complex. The basic behaviour is the same as the stereo mode, but the quad mode adds an extra BBD circuit to each stereo channel. This additional BBD is only controlled by the triangle LFO and not the sine wave LFO. However, it responds inversely to the other BBD on its channel. So as the other BBD is increasing in delay, the extra one is decreasing. And because it doesn't respond to the sine wave LFO, the output of the BBD can be very different to the other BBD on the same channel. This creates a rich rolling sound. The classic RS or VP string sound involves only the effected sound, ie. 100% wet. The triangle wave LFOs being set to fairly slow (one cycle around 5 seconds) but deep modulations. And then with a much smaller amount of faster (around 5Hz) sine wave modulation added.

TRIANGLE RATE

For use with MULTI mode only. This controls the rate of the triangle wave low frequency oscillator (LFO). An LFO produces an output signal that changes in voltage with a repeatable and periodic shape. The triangle wave output rises at a constant rate, reaches an apex and then descends at the same rate as it went up. Then at its lowest point it rises again and the process repeats itself. It is called a triangle wave because when viewed on an oscilloscope the trace is made from a series of triangles.

TRIANGLE/CHORUS DEPTH

In MULTI mode this controls the depth of the triangle wave modulation. The deeper the modulation the greater the change in delay times the BBD lines exhibit. Quick changes in delay are heard as a change in pitch by the listener. With a triangle wave the pitch changes can be quite severe as the waveform changes direction at its upper and lower limits.

In 3 PHASE mode this controls the depth of the slow 'chorus' oscillator. The waveform used is a sine wave at around 0.6Hz.

SINE RATE

For use with MULTI mode only. Controls the rate of the sine wave LFOs. A sine wave is similar to the triangle wave but the rises and falls in output voltage are more gentle. The waveform is more akin to natural resonances slowing down before it changes direction.

SINE/VIBRATO DEPTH

In MULTI mode this controls the depth of the sine wave modulation. Sine waves produce a more natural sounding pitch change when they modulate a BBD.

In 3 PHASE mode this controls the depth of the faster 'vibrato' oscillator. The waveform used is a sine wave at around 6Hz

BALANCE

This adjusts the mix between the unaffected signal and the one coming from the delay line or lines. DRY is the unaffected signal while WET is the delayed signal. The input level control affects both dry and wet signals.

For classic ensemble effects the balance is set to 100% wet. For classic chorus effects the balance is set to around 50%.

OUTPUT LEVEL

This adjusts the output level of the unit. The gain of the whole module is +16dB when being driven with an unbalanced audio signal and both input and output level controls set to their maximum.

POWER LED

This will light when power is applied to the unit. To be precise, it lights when the +15V power supply rail is up and running.

Input and Output Connections

The SRE330 has both balanced input and output connections. It is expected that the unit will be fitted with three pole TRS (tip-ring-sleeve) sockets. Both input and output are compatible with unbalanced signals and mono jack plugs can be used without detriment to the SRE330

It should work well with signal levels direct from a mixer, line level synthesisers and modular synthesisers. The input impedance is too low to work direct from guitars unless they are fitted with internal pre-amplifiers.

The SRE330's stereo inputs can be used with mono sources. Simply connect the jack plug to the right hand input socket and the input signal will be applied automatically to both the left and right inputs. In this case the INPUT MODE switch will have no effect on the signal since the input signal is already mono.

The maximum input signal level without clipping the pre-amplifier stage is +/-12V. Signal levels higher than +/-30V have the potential to damage the unit. Input impedance is 44K. Output impedance is 220R.

Calibration

There are sixteen trimmers on the SRE330. It will be useful to have access to an oscilloscope and a frequency counter for the complete calibration routine.

All voltages should be measured with respect to a suitable 0V point. That is the black lead of your meter should be connected to 0V. 0V is most easily found at the cathode of D14 on the SRE330 main board which is the end that is nearest to the power header.

Set the SRE330 so that the two modulation depth pots are at their minimum value.

CLK1 This sets the delay time of BBD line number 1.

Measure the signal at pin 6 of U32. Adjust CLK1 so that the frequency of the square wave is approximately 75kHz.

CLK2 This sets the delay time of BBD line number 2.

Measure the signal at pin 6 of U38. Adjust CLK2 so that the frequency of the square wave is approximately 75kHz.

CLK3 This sets the delay time of BBD line number 3.

Measure the signal at pin 6 of U43. Adjust CLK3 so that the frequency of the square wave is approximately 75kHz.

CLK4 This sets the delay time of BBD line number 4.

Measure the signal at pin 6 of U51. Adjust CLK1 so that the frequency of the square wave is approximately 75kHz.

OFF1, OFF2, OFF3 & OFF4 These adjust the bias point of the respective BBD line's input signal. If this voltage offset is set too high or too low then the output signal of that BBD will distort too easily. The ideal point will be when the signal running through the BBD is at its maximum without any degradation at the waveform peaks.

Input a 220Hz triangle wave or smooth sounding tone into the SRE330. Adjust the input level so that the red PEAK LED is just lit. Turn down both modulation depth pots.

Adjust OFF1 so that the waveform seen at pin 1 of U31 is not clipping at either the top or bottom of the waveform.

Adjust OFF2 so that the waveform seen at pin 1 of U37 is not clipping at either the top or bottom of the waveform.

Adjust OFF3 so that the waveform seen at pin 1 of U42 is not clipping at either the top or bottom of the waveform.

Adjust OFF4 so that the waveform seen at pin 1 of U50 is not clipping at either the top or bottom of the waveform.

NULL1, NULL2, NULL3 & NULL4 These adjust the amount of high frequency clock breakthrough into the audio output of each BBD. You want to set these so that the smallest amount of clock is getting through to the output.

Set your scope's time base to 5uS per division and the scaling to 200mV per division. Turn the input level down on the SRE330 so that no signal is passing through the delay lines. We need to monitor the voltage at the input to the first low pass filter for each of the four BBD circuits. These are the solder pads nearest to the front of the unit of R159 for BBD1, R187 for BBD2, R206 for BBD3 and R236 for BBD4.

Adjust the relevant NULL trimmer so that the waveform amplitude seen on the scope trace is minimised. Set incorrectly you'll see a kind of spiky square wave. Set correctly the trace will reduce to just a series of spikes. Do this for all four BBD lines.

T_FRQ This sets the frequency range of the triangle LFOs.

Set TYPE to MULTI and the triangle rate pot to its maximum value. Set your scope's time base to 5mS per division and the scaling to 2V per division.

Monitor the voltage at pin 1 of U8. Adjust T_FRQ until you get a 50Hz triangle wave.

T_LVL This sets the maximum output level of both triangle wave LFOs.

Set TYPE to MULTI, and the triangle rate and depth pots to their maximum. Set your scope's time base to 5mS per division and the scaling to 2V per division. Then monitor the voltage on pin 1 of U13 and adjust T_LVL until you get a 10V peak to peak signal.

S_FRQ This sets the frequency range of the sine wave LFOs.

Set TYPE to MULTI and the triangle rate pot to its maximum value. Set your scope's time base to 5mS per division and the scaling to 2V per division.

Monitor the voltage at pin 1 of U20. Adjust S_FRQ until you get a 50Hz triangle wave.

S_LVL This sets the maximum output level of both sine wave LFOs.

Set TYPE to MULTI, and the sine rate and depth pots to their maximum. Set your scope's time base to 5mS per division and the scaling to 2V per division. Then monitor the voltage on pin 1 of U25 and adjust S_LVL until you get a 10V peak to peak signal.

FAST This sets the frequency of the vibrato oscillator in three phase mode.

Set TYPE to 3 PHASE and the vibrato depth pot to its maximum. Set your scope's time base to 25mS per division and the scaling to 2V per division. Then monitor the voltage on pin 1 of U26 and adjust FAST until you get a 12V peak to peak signal. The frequency should be around 6Hz.

SLOW This sets the frequency of the chorus oscillator in three phase mode.

Set TYPE to 3 PHASE and the chorus depth pot to its maximum. Set your scope's time base to 500mS per division and the scaling to 2V per division. Then monitor the voltage on pin 7 of U14 and adjust SLOW until you get a 10V peak to peak signal. The frequency should be around 0.6Hz.

Final Comments

I hope you enjoy using the Oakley Sound SRE330.

If you have any problems with the module, an excellent source of support is the Oakley Sound Forum at Muffwiggler.com.

If you have a comment about this user manual, or have a found a mistake in it, then please do let me know either via e-mail or the forum.

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