First Edition

CONTROLS

MIC LEVEL CONTROL
(-54dBm to -14dBm)

POWER CONTROL
1.5W

DIMENSIONS: 492(W) x 92(H) x 350(D) mm

WEIGHT: 5.8kg

INPUT LEVEL INDICATORS:
LED DISPLAY: GREEN, RED/over
MIC LEVEL: GREEN, RED/over
INSTRUMENT LEVEL: GREEN, RED/over
GUITAR LEVEL: GREEN, RED/over

OUTPUTS

For GUITAR AMPLIFIER: 1/4 inch STANDARD Phone Jack (10kHz)
MONO or STEREO OUTPUTS: 1/4 inch STANDARD Phone Jack

Power switch
SD5P001 (001-156) 100V
SD5P002 (001-216) 117V
SD5P002 (001-217) 220/240V

Button
no.9 (016-009)
Panel H58 (072058)
Hexagon socket head bolt 4 x 6mm blk
2. Synthesizer (second) Filter and VDAs

Like the first filter, a musical sound signal being supplied is resolved into frequency spectrum components. Since a musical sound passing through the second group of filters is proportional to the first filter output amplitude, the spectrum of the second filter output is analogous to that of the voice signal. In other words, the second filter output is a mixture of the input musical sound signal and the first signal output. Thus, uniform sound signal spectrum would be ideal for reproduction of human voice, but it is no longer of a musical instrument.

4. High Frequency Voice Signal Bypass Filter (Resonant Filter)

Since musical sounds rarely include high frequency noise components such as "fricative" may be in voice, the second filter has no spectrum to respond to. Furthermore, such a sound, hardly relating to musical intervals, is separated from a microphone signal, passes through this circuit and is recombined with the second filter outputs.

5. Musical Sound Signal Detector

This circuit obstructs the second filter output as long as a musical sound is not supplied to the Vocoder and tells the circuits 3 and 4 whether a musical sound signal is being fed or not.

6. Hold Circuit

This circuit enables Vocoder to hold its output during an interruption in mic signal, e.g. when a singer inspires. The function can also be used for some special effect applications. During holding, this circuit retains spectrums and volume by holding amplitude detectors output voltage and expander control voltage. The compressor gain is minimized and the voice gate is turned off so as to keep voice unchanged even though mic input signal is changing.

1. Analyzing (first) Filter and Amplitude Detectors

A microphone input signal is resolved by a group of filters into frequency band components which are amplitude-detected and supplied to the VDAs of the Synthesizer Filter (second filter). Signals passing through second filters are controlled in volume at VCA by the control signal coming from corresponding frequency band of the first filter.

In the Vocoder, the voice signal from a microphone is frequency-analyzed through a group of filters to slice up a voice signal frequency spectrum featuring human voice. Then the spectrum is duplicated to another group of musical sound signal filters to obtain functions equivalent to human mouth and throat and thus to simulate human voice with musical sound signals.

Fundamental Vocoder functions are described below according to the Block Diagram shown above.
COMPRESSOR

After amplified by 14-54DB through Mic Head Amp on AP-127, Mic signal goes to IC4 (pins 5-7) whose gain is reversely proportional to the control current from Q5 emitter.

The mic signal coming from IC2 pin 7 is full-wave rectified by IC5 (pins 5-7), D1 and D2, peak-voltage detected by IC3 (pins 1-3), D4, smoothed to DC voltage by IC5 (pins 1-3), and V-I converted by IC4 (pins 1-3), Q6. Connected across IC4's pins 6 and 7 in parallel with feedback resistor is IC1 R4662. As the mic signal increases, Q5 output current increases, that causes IC4662 conductance to increase, lowering the gain of IC4 (pins 5-7) to retain either half peak output from going above 10V (20Vpp).

In this Vocoder, there are two other compressors similar to the Mic compressor in configurations: Guitar preamp chain and Synthesizer filter output channel.

EXPANDER

The output voltage at pin 1 of IC6 is also received by Expanders IC17-20, Q22 and Q23. The current from Q22 (Q23) varies in the same direction as in the Compressor, but with this fashion, signal flow rate through IC18 (1080) is directly proportional to the control current; the more current flows, the more signal flow through IC18.

ANALYZER FILTER

Ten HPFs with a high Q consisting of IC6 (e.g. IC50 and IC55) covers most of the audio spectrum - speech signal.

The signal from the Compressor is pre-emphasized through IC5 (pins 5-7) and fed to the Filter bank which slices up the spectrum. Each slice goes to a diode(e.g. D37) where its peak is detected, smoothed and is fed to the VOA in the next stage filter -Synthesizer filter. This is a control voltage that is proportional to the strength of that slice.

SYNTHESIZER FILTERS

The Synthesizer filter is a set of bandpass filter, identical to those of the Analyzer section, is fed by the signal coming through either INSTRUMENT or GUITAR preamp and HARMONIC circuit. The filter bank slices up instrument sound spectrum into bands in the same way Analyzer filter does on the speech spectrum. Each slice then connects to voltage-controlled amp -VOA.

VOA

During an absence of signal in Analyzer filter(e.g. IC50 (IC55), IC65), negative peeks of triangular wave on pin 10 of IC33 is kept positive -determined by VR8 - with respect to the pin 11, disabling switching gate -IC32.

When the voltage from IC33 increases to a some extent, it exceeds lower portion of triangular wave, causing IC33 pin 13 turns to "H" which in turn gates IC32 on. When positive going triangular wave reaches above the voltage on pin 11, pin 13 turns to "L" and IC32 turns off. Thus signal flow rate through IC32 depends on the width of pulse from IC33 and pulse width is proportional to IC33 control voltage, pulse duty signals are smoothed while they are passing through the next filter -IC39.

SOUND DETECTOR

During an absence of musical instrument's signal, Vocoder shunts inadvertent signals in under the coordination of a system. The Sound detector is the first stage of the system.

IC45 (pins 5-7), D51 and D62 make up a full-wave rectifier, the average output voltage is peak of the signal delivered by IC21 pin 1, then IC45 (pins 1-3) provides adequately smooth IC output from pin 1.

When this voltage - at pin 4 of IC37 - exceeds a voltage at pin 5, pin 2 goes to negative, cutting Q29 off, removing the ground from pin 2 of IC17(1C19). Expanders are now ready to function.

IC37 pin 7 also sees Sound Detector's output and determines pin 7's output pulse width which in turn regulates HPF signal flow rate. While Synthesizer filter VOA responds to speech spectrum, HPF VOA to the instrument's.
1. MIC COMPRESSOR GAIN

Make sure that the Red LED on the MICROPHONE section goes on and stays on in above set-up.
Adjust VR-1 for 20Vpp at TP-2.

2. GUITAR COMPRESSOR GAIN

Feed a signal, 1kHz, sine, -5dBm into GUITAR input jack.
The Red LED on the GUITAR section should light and stay on.
Adjust VR-2 for 20Vpp at TP-6.

Waveform Checking
With HARMONICS knob turned fully clockwise, a waveform similar to the waveforms in the figure bellow should be seen at TP-20.

3. VOICER SOUND COMPRESSOR GAIN

Feed a signal, 1kHz, sine, 0dBm, into TP-35.
Adjust VR-3 for 20Vpp at TP-12.

"11": top
To make sure of the compressor function, slide knob "11" down to lowest. The waveform has just reduced to some extent (depends on knob's traveling speed) is rising and will stop when it reaches half an amplitude of earlier.

4. VCA TRIANGULAR WAVEFORM FREQUENCY

Use a 10:1 probe for trace clarity.
Adjust VR-9 for 50μs period.

5. VCA CUT-OFF BIAS

Feed white noise, 1Vpp into GUITAR input jack.
Slide up CHARACTER CONTROL FREQUENCY knobs "1" to "10" to the top.
Adjust VR-8 until the noise signal just disappears. Excessive turn will result in low VCA output.

NOTE
If this adjustment failed noise reduction, slide down the knobs individually. The signal leaking through a filter will decrease as the corresponding knob being slide down. Check the Analyzer and Synthesizer filters in that frequency chain for malfunction.

6. EXPANDER DC BALANCE

Place a ground on TP-15.
Plug a blank plug into ENSEMBLE jack to open the jack circuit.
a. Connect TP-16 to a ground. Adjust VR-4 so that TP-17 becomes OV DC.
b. Connect TP-19 to a ground. Adjust VR-5 so that TP-18 becomes OV DC.

7. EXPANDER GAIN

Feed a signal, 1kHz, sine, -5dBm into TP-15.
Connect TP-16 and TP-19 to the ground.
a. Adjust VR-6 for 8Vpp at TP-17.
b. Adjust VR-7 for 8Vpp at TP-18.

BBD MODULATING VCO WAVEFORM CHECKING

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\begin{align*}
T &= 4-5\text{sec (approx.)} \\
&\text{at TP-30} \\
&\text{OV} \\
&+10\text{V}
\end{align*}
\]

\[
\begin{align*}
T &= 0.2-0.3\text{sec} \\
&\text{at TP-31} \\
E &= 1Vpp \text{ at TP-31}
\end{align*}
\]

\[
\begin{align*}
T &= 4\mu s-15\mu s (\text{approx}) \\
&\text{at TP-23, TP-29}
\end{align*}
\]

Being modulated by the composite signal (sine and triangular waveforms), the waveforms at TP-23 and TP-29 sweep slowly with joggling.