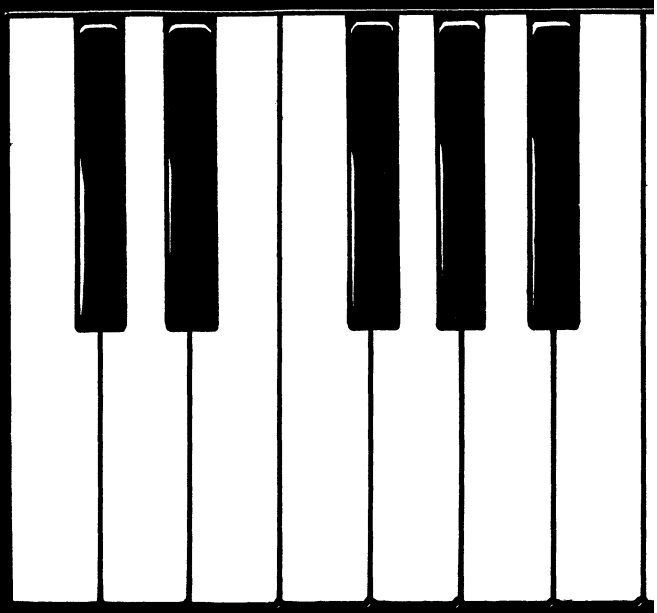
TEISCO

synthesizer

S-110F

S-60F



# owner's manual

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Thank you for your purchase of the TEISCO Synthesizer S-110F/S-60F. S-110F/S-60F is a high-performance free-type synthesizer which is capable of creating not only the sound like the natural one of every kind of musical instruments such as violin, flute, piano, etc., but also the sound peculiar to the synthesizer at your disposal. In other words, it is an entirely new type of instrument which creates the very timbre by musician's own sense.

You can enjoy effective sound creation so easily through a number of controls once you comprehend their basic principle.
Careful reading of this manual describing the fundamental principle as well as the handling of each section in the following will enable you to use your new TEISCO Synthesizer S-110F/S-60F to its full capability for ever.

# 1. Preface & Features

## S-110F

**A control type monophonic synthesizer featuring two VCOs.**
**If you are seeking for a synthesizer with a fine balance of price, function, sound versatility and roadworthy construction, the Teisco S110F is sure to be your choice.**

**Filter bank**: The S110F features the 8-point fixed filter banks, for the first time, in the synthesizer of this class. Choosing any of the fixed frequencies, it permits the release of the formant peculiar to any musical instruments.

**Indicator (LED)**: The LED flashes On and Off to tell you the signal-flow-way and the frequency alteration of VCO and VCF. The level of the filter banks is shown in the LEDmeter.

**The wave form of LEO** is continuously variable to give you a variety of effects.

**6-point touch sensor**: By one finger touch, you can control the pitch of VCO-I & II, the cut-off frequency of VCF and, in addition, Vibrato/Wow.

**Portamento**: With the 3-position mode selector, you can easily select various delicate portamento shadings for just-right effect.

**Transpose switch**: Cooperating with the switch, the S110F performs the work of 61 keys.

**The low frequency of VCO** lets you enjoy the dual modulation together with LFO.

**The pitch control of VCO-I** provides the pitch interval between two tones at your own free will.

**Bender control**: It allows attack and decay. You can creat the sensitive attack unique to the whistle sound, for example.

## S-60F

**In spite of its compact size, which lets you place it anywhere, the Teisco S60F offers full functions and controls to your sound creation.**

**Touch sensor**: You can get the Bend-up and down by one touch as you will. It is most effective to your sound expression at the live stage.

**Indicator (LED)**: The LED flashes On and Off to tell you the signal-flow-way.

**The wave form of LFO** is continuously variable to give you a variety of effects on your playing.

**VCO frequency range selector** has LOW which offers you the powerful lowest sound.

# 2. Sound Generation

## (1) Sound Generation and Three Elements of Sound

Sound is generated by the vibration of such a body as the resonant board of a piano, the diaphragm (cone paper) of a loudspeaker, etc. or by the intermittent throttling of air stream in a trumpet, clarinet, etc.

We feel that "sound" is heard when the waves of air caused by the vibration of a body, etc. are transmitted to vibrate our eardrum.

Moreover, the sound has three elements: pitch, timbre and loudness. These elements vary in a complicated manner to form an individual tone of various musical instruments.

## (2) Pitch

Sound is generated by the vibration of a body, as described above, and the pitch of sound depends upon the frequency of vibration per second. (See Fig. 1.)

For instance, when a tuning fork is tapped, both legs vibrate, causing the dense and sparse waves of air, as shown in Fig. 2 (a). In the dense parts of these air waves, the pressure is a little higher than the atmospheric pressure, while in the sparse parts, the pressure is a little lower than the atmospheric pressure.

These air waves can be represented as a "waveform" with the atmospheric pressure and time as axes, as shown in Fig. 2 (b). A complete set of wave change is referred to as "one cycle", and the number of cycles caused in 1 second is referred to as "frequency" in the unit of "Hertz".

For instance, as a tone fork of tone A vibrates 440 times per second, its pitch, namely its frequency is 440 Hz.

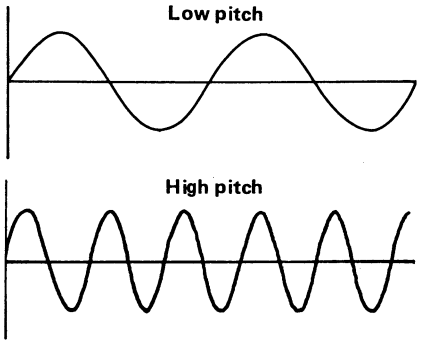



Fig. 1

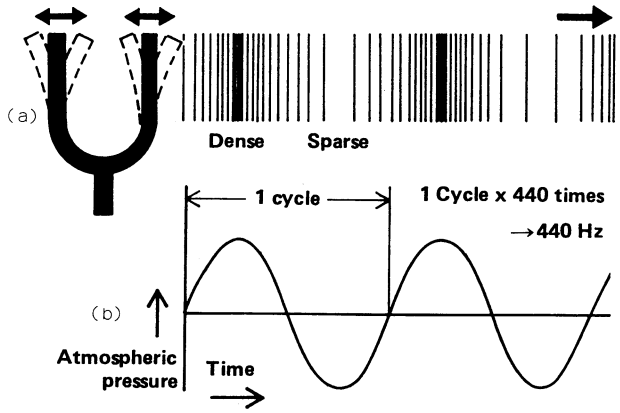



Fig. 2

## (3) Audible Frequency Band and Scale

There are numberless tones from low to high frequency, and the range of the frequencies we perceive as sounds at the ears is referred to as the "audible frequency range", which is normally 16 Hz through 16,000 Hz. Besides, the tones of a musical instrument arranged in the order to their pitch are referred to as "scale". The frequencies of musical notes of a scale are shown in Fig. 3.
The frequency of the sound generally used for music is between 30 Hz and 4,000 Hz.

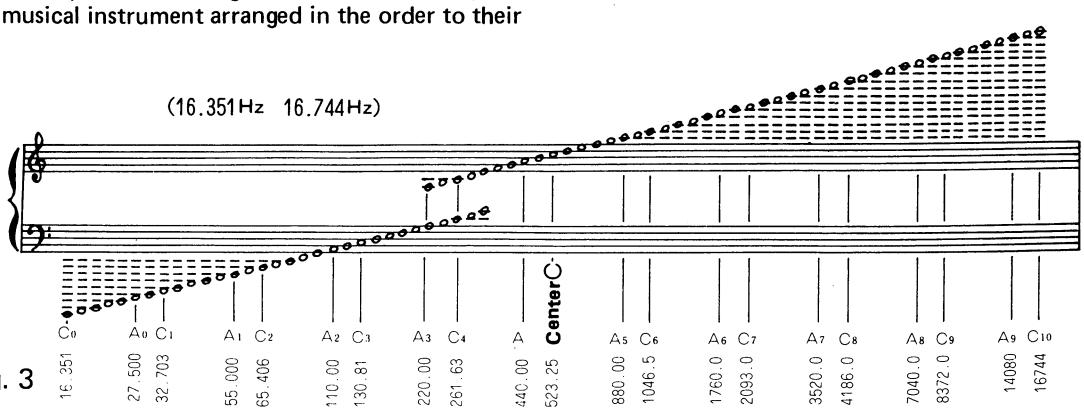



Fig. 3

## (4) Timbre and Sine Wave

The tone of instruments, voice, etc. has a complicated waveform, and every kind of waveform can be regarded as a combination of sine waves of different frequencies.
For instance, a complicated sine wave as shown in Fig. 4 (a) can be decomposed into fundamental sine waves (fundamental waves) and the sine waves which have the frequency higher than that of the fundamental waves, namely, a harmonic tone. The difference of the tones of violin and flute depends upon the ratio of the fundamental waves to the harmonic tones contained, as shown in the spectrum diagram of Fig. 4 (b). Generally speaking, the sound containing more harmonic tones is felt harder, while the sound containing less harmonic tones is softer and milder to the ear.
The waveform shown in Fig. 1 (b) is the one that has only one frequency among the sine waves as the basis of sound and has a constant amplitude.

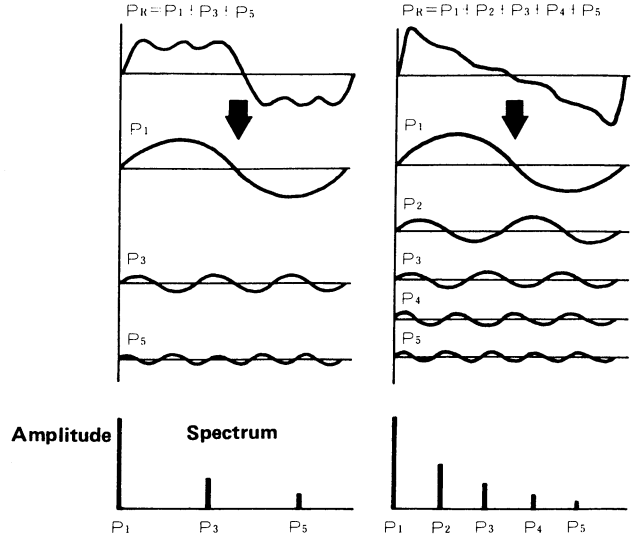



Fig. 4-a

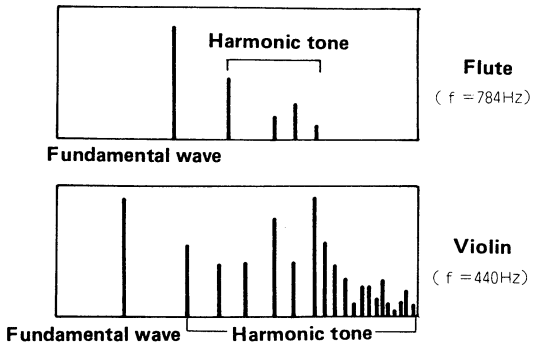



Fig. 4-b

## (5) Sound Volume

The different sound volumes caused by the performance of musical instruments, etc. depends upon the amplitude of a waveform, as shwon in Fig. 5.

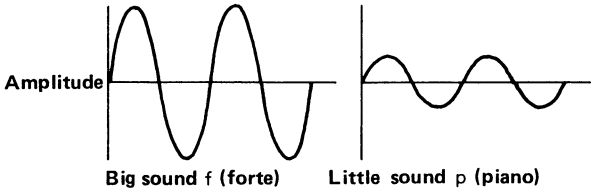
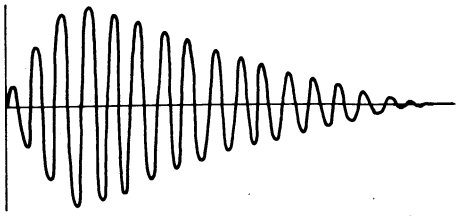



Fig. 5

## (6) Change of Sound in Course of Time

The individual tones of musical instruments, voice, etc. are not always constant. The pitch, timbre and volume change in a complicated manner until one sound disappears after it was generated.
The sound of a piano shows, for example, not only the change of sound volume which is sudden and large at the beginning and is lessened by and by but also the change of timbre which contains many harmonic tones at the beginning and loses them as the sound is lessened. (See Fig. 6-a.) Moreover, vibrato, wow-wow and tremolo which are used in the performance of a musical instrument are the effects which can be attained by periodically changing the pitch, timbre and volume. (See Fig. 6-b.)



Change of the volume of the piano (In reality, both of tone quality and waveform change in course of time.)

Fig. 6-a

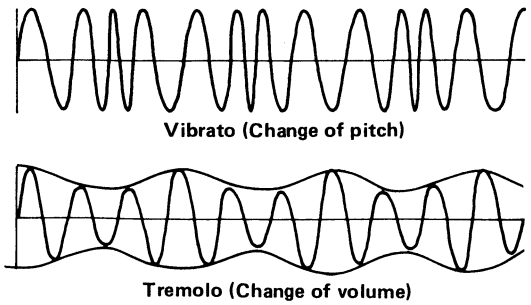



Fig. 6-b

# 3. Understanding synthesizer basics

As already described, sound consists of 3 elements: pitch, timbre and volume. These elements correspond to the frequency, waveform and amplitude of the waves of sound, respectively.
The synthesizer sets these three elements of sound in the blocks of VCO, VCF and VCA and creates sound change in course of time by an envelope generator (EG) and LFO. (See Fig. 7.)
In other words, every kind of the sounds of musical instruments such as flute, clarinet, trumpet, piano, etc. as well as human voice and the sound characteristic to the synthesizer can be created at will by the operation of these controls.

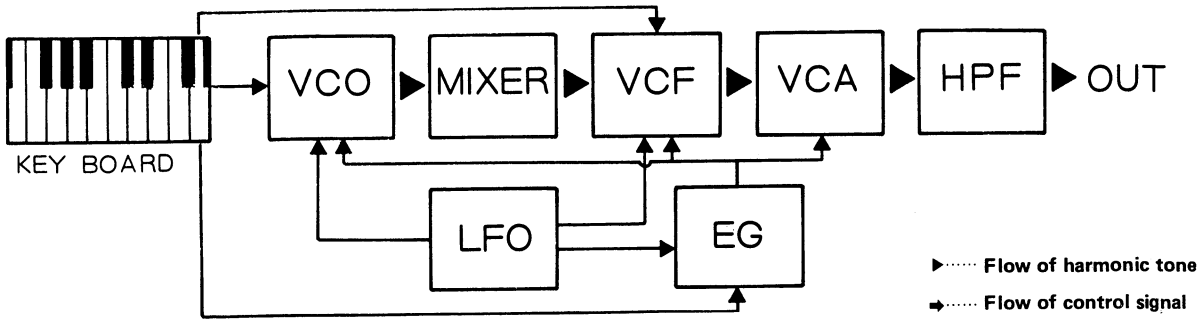



Fig. 7 **Fundamental block diagram**

## (1) Pitch and VCO

The pitch depends upon the number of vibration per second, namely, the frequency. The synthesizer produces the waveform as the sound source by VCO (Voltage Controlled Oscillator) to determine the pitch. VCO refers to an oscillator which is controlled by voltage. The frequency of the waveform produced by an oscillator depends upon a given voltage, and thus, if the voltage rises, then the frequency will be high.
The keyboard of the synthesizer is used to send the voltage for controlling VCO. Every time a key is pressed, the voltage corresponding to the key is generated. The musical scale can be obtained in this manner.
In addition to this, "portamento" which is the effect characteristic to the synthesizer can be attained by applying a smoothly varying voltage to VCO.

## (2) Timbre and VCF

The timbre depends upon the waveform. In the case of the synthesizer, the timbre is determined by VCF (Voltage Controlled Filter). In other words, since the waveform (rectangular waves and saw tooth waves) generated by VCO includes many harmonic tones, VCF produces a variety of timbres (waveforms) by cutting off these harmonic tones, laying emphasis upon only a specific frequency, and so on. VCF refers to a filter which is controlled by voltage.
For instance, the saw tooth wave generated by VCO is a tone which is heard cheerful to the ear like that of a violin which contains many harmonic tones of an integrally multiplied frequency, compared with the fundamental wave. If this is gradually cut from higher harmonic tones by VCF, it will be a softer tone, and thus the timbre like that of a flute can be made.
Besides, there is noise (the noise that is heard between the stations of FM radio) as a sound source, and by changing the control voltage of VCF periodically, imitation sounds of waves, wind, etc. can be created.

## (3) Volume and VCA

The sound volume depends upon the amplitude of a waveform. In the case of the synthesizer, the sound volume is determined by VCA (Voltage Controlled Amplifier).
VCA refers to an amplifier controlled by a voltage. It controls the level of the low-level signals sent from VCO and VCF by a voltage.

## (4) Sound Change in Course of Time and Envelope Generator (EG)

The volume and timbre of the individual sounds generated by different musical instruments are not contant, and they change in a complicated manner until sounds disappear after they were emitted.
The changes of the volume and timbre of individual sounds such as attack, decay, sustain and release and caused by controlling VCA and VCF by envelope generator voltage. (See Fig. 8.)
The envelope generator generates the voltage set by 4 volumes of Attack (A), Decay (D), Sustain (S) and Release (R) every time the keys are pressed, so that various sounds similar to those of musical instruments can be created.

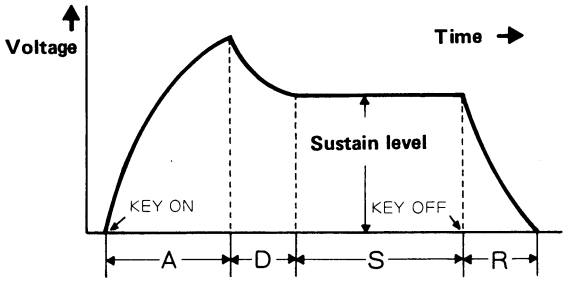



Fig. 8-a Waveform of Envelope

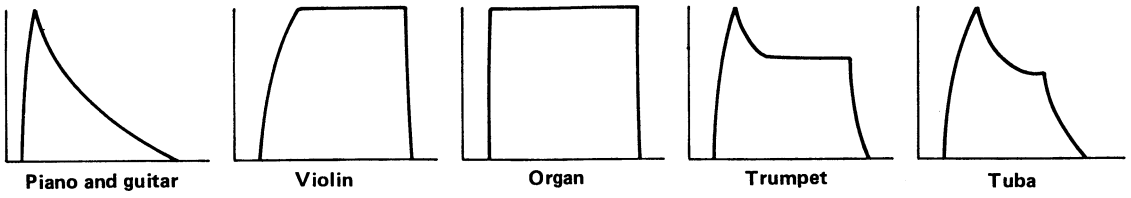



Fig. 8-b **Various output waveforms of EG**

## (5) Periodical Change of Sound and LFO (Low Frequency Oscillator)

A variety of effects can be obtained by periodically changing the pitch, timbre and volume of sound. LFO refers to a low-frequency oscillator which generates very low frequencies. Controlling VCO by LFO, the vibrato effect and the sound of a siren can be obtained. Controlling VCF by LFO, on the other hand, you will obtain the effect of wow-wow and growl. (See Fig. 6-b.)

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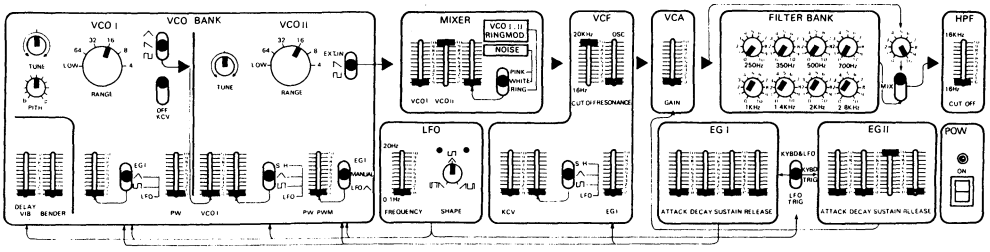
The fundamental construction of the synthesizer has been described above, and the synthesizer is provided with various additional functions such as touch senser, HPF (high-pass filter), filter bank, etc. so that the sound like those of natural musical instruments as well as original sounds can be created.

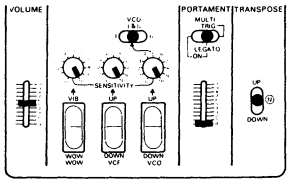
Moreover, you can enjoy versatile playing by using this instrument together with not only effecters such as echo chamber, etc. but also a sequencer, an electronic organ, etc. The panel layout of S-110F/S-60F is so designed that the signal flows, roughly speaking, from left to right, except the switches which are frequently operated. (Fig. 7)

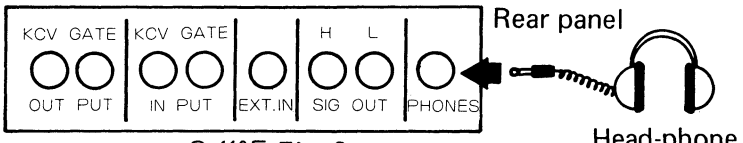
# 4. Basic Sound Creation

**(1)** To emit sound , set this instrument as shown in the figure below. (Fig. 9 for S-110F and Fig. 10 for S-60F)
This setting is fundamental, and if no sound is emitted during operation, restore setting to this state.
For the simplest listening to sound, it is advisable to make use of an audio headphone (4 – 8Ω).

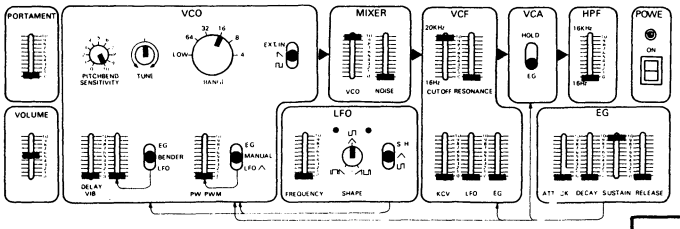



S-110F

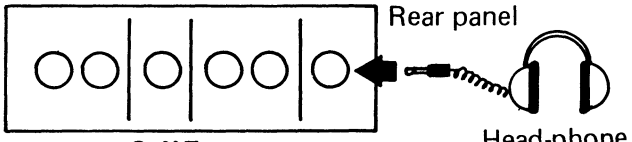



S-110F Fig. 9




S-60F




S-60F Fig. 10

**(2)** If the key is pressed in the above-described setting state, the sound of saw-tooth waves will be emitted. If two or more keys are pressed at the same time, a higher tone will take priority.
In addition ot it, since the flow of harmonic tones is indicated by the lighting of ▶(green lamps), no sound will be emitted unless all of ▶ light up. Since harmonic tones flow roughly from left to right, if no sound is emitted, there must be an error in the setting of the blocks on the left side of ▶ which does not light up.

# 5. Connection Diagram

**1 PHONES (Head-phone terminal)**
Connect a general audio head-phone (dynamic stereo type, 4 ~ 8Ω) to this terminal. However, the output is monaural.

**2 SIG.OUT (L. –20 dBm)**
Connect an effecter (input terminal) such as a guitar amplifier, a mixer, an echo machine, etc. with this terminal.

**3 SIG.OUT (H. +4 dBm)**
Connect a stereo amplifier (Aux. – In.), a PA speaker with a main amplifier, or an electronic organ with this terminal. If the volume is too large or the sound is distorted when an electronic organ is connected, lower the volume of this instrument.

**4 EXT.IN (–25 dBm)**
Connect a guitar with this terminal. In this case, set the VCO waveform select SW (the VCOII waveform select SW in S-110F) of this instrument to EXT.IN. If the sound is distorted, lower the VCO volume (VCOII volume in S-110F) in the mixer block of this instrument.

**5 GATE.IN**
If the signal (⎍) of 2 V to 15 V comes, the instrument will operate.

**6 KCV IN (1 oct./1V)**
The standard is 1 oct./1V, the worldwide unified standard. This instrument can be controlled by another S-110F or the like.

**7 GATE.OUT (S-110F only)**
If a key is pressed, the gate signal (⎍) of 0 – 14 V will be put out.

**8 KCV.OUT (1 V/1 oct.) (S-110F only)**
A synthesizer of the same standard such as another S-110F, S-60F, etc. can be controlled. If the transpose is used, a voltage of –1 ~ 4V can be sent.

* Every output of output terminals ①, ② and ③ can be adjusted by the volume of this instrument. Therefore, if the volume level is set to "0", no signal is sent to the output terminals.

* KCV ..... Key Voltage
GATE ..... The signal which indicates whether a key is pressed or not.

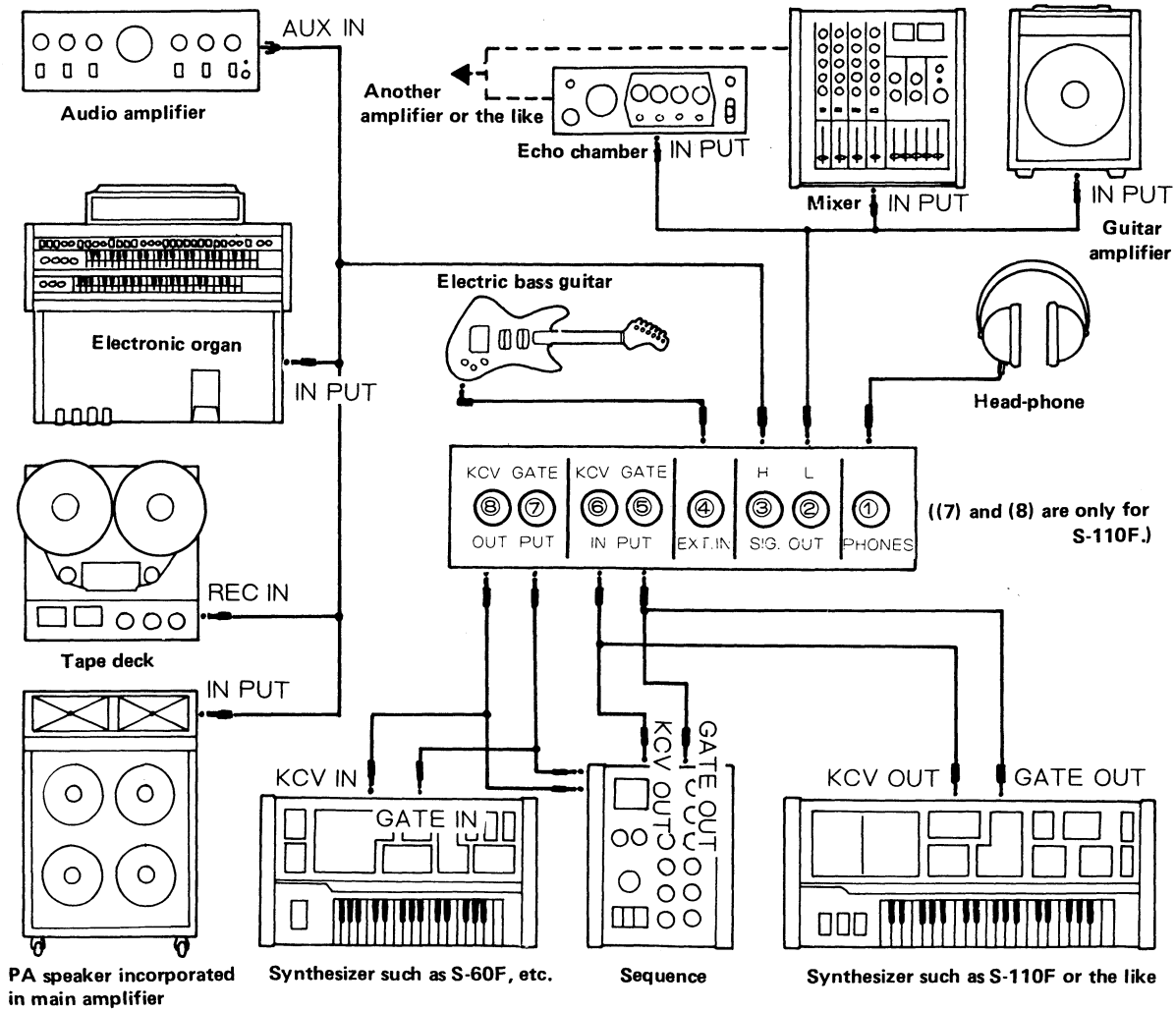



Fig. 11

# 6. Keyboard and Tuning

## (1) Keyboard

S-110F has a keyboard of 37 keys (C – C) and S-60F has a keyboard of 32 keys (F – C), though the scale of 109 keys (9 octaves) in the case of S-110F or 79 keys (6-1/3 octaves) in the case of S-60F can be obtained by the VCO range selector or the transpose SW to be described later.

## (2) KCV (Key Voltage)

The keyboards of S-110F and S-60F generate the voltage corresponding to a pressed key to control VCO. This voltage changes by 1 Volt per octave (1 V/Oct.), following the standard which is being unified worldwide. Therefore, this instrument can be connected with a sequencer, an organ or another synthesizer of 1 V/Oct.
The voltage corresponding to each key is shown in Fig. 12.

## (3) Keyboard and VCO

If two or more eys of S-110F are pressed at the same time, the sound of VCOII will be emitted from the highest key, and the sound of VCOI from the lowest key. This is because the high/low tone priority circuit in the keyboard operates. On the other hand, if only one key is pressed, the sounds of VCOI and VCOII will be emitted at the same time.
If two or more keys of S-60F are pressed at the same time, the sound of the highest key will take priority.

## (4) Tuning

Carry out tuning about 2 minutes after turning on the power switch (during which the circuit is more stabilized). For tuning reference, adjust to 440 Hz the second A (the section indicated by a red line in Fig. 12) from the bottom at the time when the range is set to 16 feet, or adjust the central C (the section indicated by a black line in Fig. 12) to the C of a piano or a tuning fork.

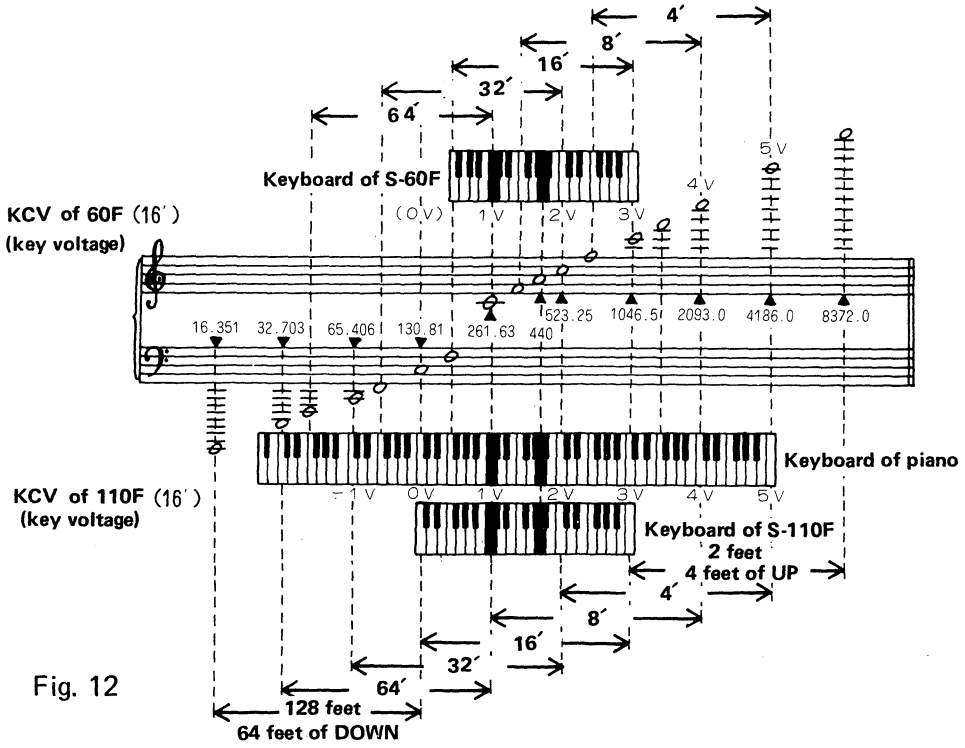
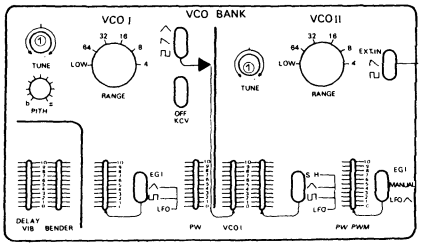
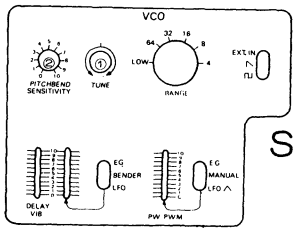



Fig. 12

Tuning is made by tuning knob ①. This knob can be moved vertically over all tones and steps referring to the center.
In the case of S-110F, after tuning VCOII at first, raise the VCOI volume in the mixer block (Fig. 22-a ①), and adjust the step of VCOI to that of VCOII while pressing the key. However, leave the pitch knob of VCOI in the center.




S-110F Fig. 13-a




S-60F Fig. 13-b

### 1 Portamento time

The effect that the pitch changes smoothly is referred to as portamento. (Fig. 15)
When the portamento time is fully raised to the up end, the pitch change for about 2 seconds from an end to the other end of the keyboard can be obtained.

### 2 Portamento mode (S-110F only)

ON ..... When the portamento knob ① is set upward, the portamento effect can be obtained both in legato execution and in staccato execution.

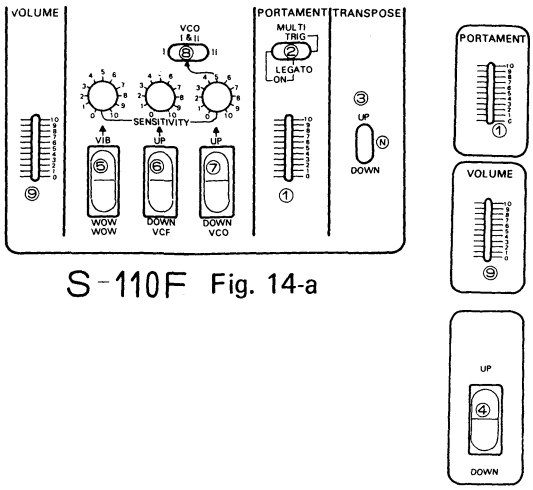
LEGATO ON .. When the portamento knob① is set upward, the portament effect can be obtained only in the laegato execution Therefore, the portamento effect can be obtained at will during perfor mance.

MULTI PRIG ...EG operates every time the scale changes. Although portamento is not valid, trigger is valid even in the performance by legato execution, and attack sound can always be obtained.

* In the case of S-60F, when ① is raised, the portamento effect can be obtained both in legato execution and in staccato execution.

### 3 Transpose (S-110F only)

With this knob in the position "up", you will obtain an interval higher by one octave on all the keys.
With it "DOWN", you will obtain an interval lower by one octave. If the transpose is operated while pressing the key, the portamento effect can also be obtained.




S-110F Fig. 14-a

S-60F Fig. 14-b

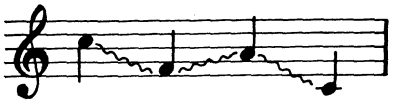


Fig. 15 Tone of Portamento

# (Touch Sensitive Modulation)

With the touch sensers ④, ⑤,⑥ and ⑦ described below, you can add to the sounds the effect corresponding the pressing force when any of them is pressed during performance. Moreover, as being the sensors of automatic release type, they are very excellent in both of operation and creativeness, and thus, they are very sueful in the plays such as the tuning execution of guitars, the solo manual wow, etc.

### 4 Pitch bend (S-60F only)

It allows the sound to be slided up and down at will during performance. The degree of the effect is adjusted by the pitch bend adjusting knob (Pitch Bend Sensitivity) illustrated in Fig. 13-b 2 .

### Touch sensors and adjusting knobs 5 , 6 and 7 (S-110F only)

**5** It allows the WOW WOW/VIB effect to be obtained during performance. When VCF is controlled by LFO, the wow wow effect can be obtained, and when VCO is controlled by LFO, the VIB (vibrato) effect, namely the periodical variation of timbre or step can be obtained.

**6** It allows VCF to be controlled during performance. Therefore, the change of timbre can be obtained, and if UP is pressed, the sound will be harder, while, if DOWN is pressed, the sound will be softer.
VCO can be controlled during performance. Therefore, the change of the step can be obtained. If UP is pressed, the pitch will be high, and if DOWN is pressed, the pitch will be low.

**7** The effects of ⑤, ⑥ and ⑦ can be adjusted by the knobs (SENSITIVITY) respectively.

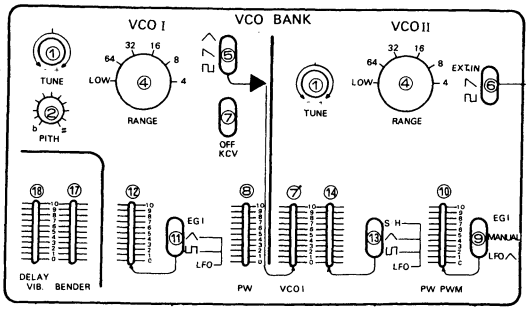
### 8 VCO mode (S-11F only)

It selects VCO to be controlled by 7 : VCOI, VCOI & II and VCOII. When it is set to VCOI & II, both VCO's are controlled.

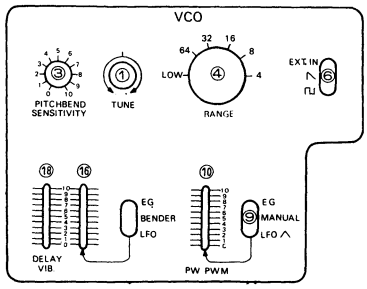
### 9 VOLUME

It adjusts the volume. Each output terminal on the rear panel (Fig. 11 – ①, ②, ③) is controlled by this volume.

# 7. VCO Bank




S-110F Fig. 16-a




S-60F Fig. 16-b

This section produces the waveform to be the sound source of the synthesizer, and two VCO's which determine the pitch are incorporated in S-110F. For the emittance of an accord, VCOI corresponds to the higher tone, and VCOII to the lower tone. Moreover, the modulation from VCOI to VCOII can also be applied.

## 1 TUNE

This knob is used to tune the pitch of the synthesizer. It can vary nearly the gamut (200 sent) up and down with reference to the center. In the case of S-60F, if 4 range is set to LOW, the pitch will change up and down by approximately 5 octaves.
In the case of S-110F, with this knob, you can also tune the pitch of VCOI to that of VCOII or shift a little the former from the latter.

## 2 PITCH (S-110F only)

As there is provided a click in the center, the pitch can instantly be changed or restored during performance. The pitch can be changed up and down by about 1 octave, and the pitch difference of 4 or 5 degrees from that of VCOII is available.

## 3 PITCHBEND SENSITIVITY (S-60F only)

As described in the preceding paragraph, the sound is changeable about 1/2 octave when this knob is dialed to the right end, adjusting the pressing of thee PITCH BEND (Touch sensor).

## 4 RANGE

With this knob, you can change over the compass of VCO. It changes by 5 octaves from 4' (feet) to 64'. When the transpose is used jointly in the case of S-110F, the range covers the frequency 16.35Hz~8,372Hz. Setting this knob to LOW and adjusting the Pitch Knob ②, the pitch is changeable up and down by about 5 octaves (0.3 ~ 1 kHz).
The LOW range of S-110F VCOI is used mainly for applying modulation to VCOII. The LOW range of S-110F VCOII and S-60F is used mainly to bring about imitation sound effect.

## 5 WAVEFORM (S-110F only)

With this switch, you can select the waveform of VCOI.

△ ——It is a waveform which is referred to as triangular shape, and it contains more or less odd harmonic tones. When harmonic tones are but by VCF, the sound near to sine waves can be obtained.

◺ ——It is a waveform referred to as saw tooth shape and it contains many odd and even harmonic tones. It is oftenest used to create the brass sound, string sound, synthetic sound, etc.

⊓⊔ ——It is a waveform which is referred to as symmetric rectangular shape. It contains many odd harmonic tones, and its timbre is like that of the clarinet. The unsymmetric rectangular shape (⊓⊔) can be also created by ⑧ pulse width.

## 6 WAVEFORM

It is a switch for selecting the waveform of VCOII (S-110F) and that of VCO (S-60F).
EXT IN ... It is set when another musical instrument is connected to EXT IN (Fig. 11 ④) on the rear panel. The sound level of the external signal is adjusted by the VCO volume (Fig. 22) in the mixer block. (−20 dBm)

## 7 7' KCV (S-110F only)

When it is set to OFF, the frequency of VCOI will be always as high as the second C from the bottom. Since the oscillation frequency of VCOI is constant, FM modulation can be applied to VCOII by this oscillation frequency. The frequency can be changed by pitch ② or range ④. The modulation depth to be applied to VCOII is adjusted by ⑦.

## 8 PW (S-110F only)

It sets the pulse width which, when ⑤WAVEFORM is set to symmetric rectangular shape (⊓⊔), turns this into asymmetric rectangular shape (⊓⊔). The pulse width refers to the value which represents the ratio of the upper width of a rectangular shape to the lower width. In the case of a symmetric rectangular shape, the ratio of the upper width to the lower one is 50%: the smaller the upper width (the smaller the pulse width), the more the harmonic tones contained. In the case of this slider, the pulse width is 10% at 0, and 50% at nearly 8. The effect like a fuzz guitar can be obtained.

## 9 10 PW/PWM

When the PWM mode switch ⑨ is set to MANUAL, the above-described pulse width can be changed by the slider ⑩. Therefore, the operation is same as that of ⑧.
In addition to the use at the value set by ⑩ in advance, the pulse width can also be changed by EG or

LFO. To control the pulse width every time the key is pressed by EGI, set the switch ⑨ to the upper position EGI, and to control the pulse width periodically by LFO, set the switch to the lower position LFO. (In the case of S-110F, VCOII is controlled.)
When the pulse width is controlled by EGI (pulse width modulation), the effect as if a string were flipped can be obtained, and when pulse width modulation is carried out by LFO, the effect like chorus can be obtained (See Fig. 18-a,b). The modulation depth is adjustable respectively by the slider ⑩.

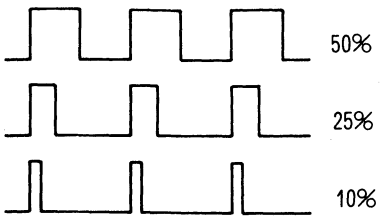


Fig. 17 Pulse Width

**11 12 Frequency Modulation (S-110F only)**

It is referred to as frequency modulation (FM) that a pitch is periodically changed. Three selection of EGI, LFO (⩘) and LFO (⊓⊔) is available. The depth of modulation can be adjusted by the slider ⑫. (VCOI is controlled).
When FM is applied by EGI, the change of the pitch like a siren can be obrained, and when FM is applied by LFO, the effect like vibrato or a marimba can be obtained. (Refer to Fig. 19-a,b,c).

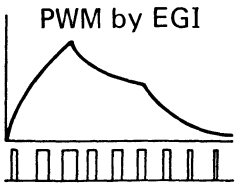


Fig. 18-a

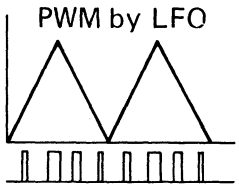


Fig. 18-b

**13 14 Frequency Modulation (S-110F only)**

Use the select switch ⑬ when FM is applied to VCOII. LFO (⩘) and LFO (⊓⊔) are same as ⑪. When this switch is set to S/H (Sample Hold), a random pitch can be obtained. Sample hold refers to sampling the input shape (noise) by pulse-like shape of constant intervals to produce an irregular step voltage, and thus, it is possible to control VCF in addition to VCO (Fig. 20). The depth of modulation is adjusted by the slider ⑭, and this period is controlled by LFO (Fig. 30-①)

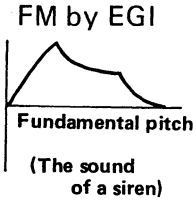


Fig. 19-a

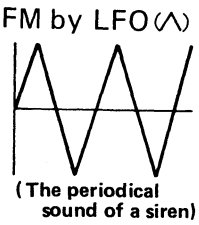


Fig. 19-b

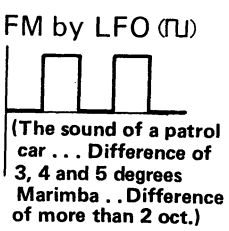


Fig. 19-c

**15 16 Frequency Modulation (S-60F only)**

Use the select switch ⑮ when FM is applied to VCO. It can be set to EG, BENDER and LFO, respectively. The effect that the envelope is functioning can be obtained at EG, the delicate attack sound (Fig. 21) at BENDER and the effects of vibrato, siren sound, etc. at LFO. The output waveform of and S/H can be set by the select switch in the LFO block (Fig. 30b-③). The depth of modulation is adjusted by the slider ⑯.

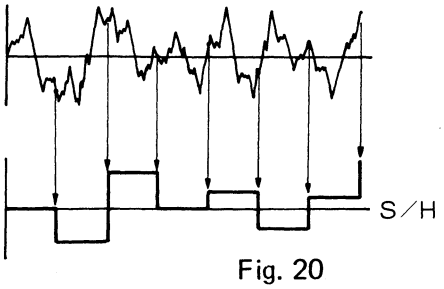


Fig. 20

**17 BENDER (S-110F only)**

Use this slider to automatically apply the pitch bender to VCOI and VCOII. The pitch difference is up to 5 degree. (Refer to Fig. 21)

**18 DELAY VIB.**

It is a slider which adjusts the depth of vibrato:
Although the speed is determined by LFO, the delay time is set in advance, so you will get the vibrato effect approximately 0.4 second after the key is pressed, and thus, more natural effect can be obtained.
In the case of S-110F, it is applied to VCOI and VCOII.

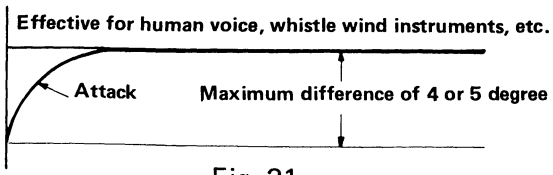
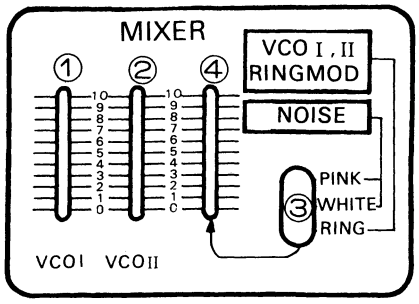


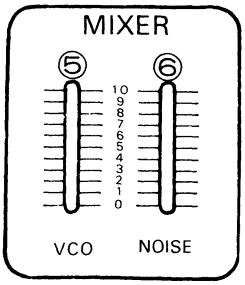
Fig. 21

* Every speed of PMW, FM and DELAY VIB described above is determined by the FREQUENCY (Fig. 30-①) of LFO to be described later. Adjust the speed at this LFO Frequency (except ⑦).

# 8. Mixer




S-110F Fig. 22-a




S-60F Fig. 22-b

The mixer has the function of producing more versatile sounds by combining VCOI and VCOII, or VCO with NOISE, and so on.

### 1 2 VCOI, VCOII (S-110F only)

Use the sliders to adjust the outputs of VCOI and VCOII, respectively. The timbre varies in diversity depending on how to adjust the two sliders. Various ways of setting VCOI and VCOII are available as follows:

a ... Combination of the same waveform in the same range

b ... Combination of the same waveform in different ranges

c ... Combination of different waveforms in the same range

d ... Combination of different waveforms in the different ranges

Thus, the effect characteristic to each combination can be obtained.

### 3 4 Ring Modulator and Noise (S-110F only)

Three selections are available by the switch ③; PINK noise, WHITE noise and RING.

The white noise is same as the inter-station noise of an FM tuner, while the pink noise is a sound as if the high compass is cut. These two are used to create imitation sounds such as the wind, wave, etc. The RING modulator brings about the sounds of the frequencies which are the sum and difference of the frequencies of VCOI and VCOII. That is to say, an entirely different sound is produced, depending upon the difference of the range or tuning of VCOI and VCOII, whether or not external signal (EXT IN) is put in VCOII, and so on. It is used to create the sound effect as if you ring a metal.

The outputs of each NOISE and RING are adjusted by the slider ④. The Ring Mod is produced by VCOI (⎍⎍) and VCOII (⎍⎍). Therefore, the timbre can be changed by the slider of PW/PW.

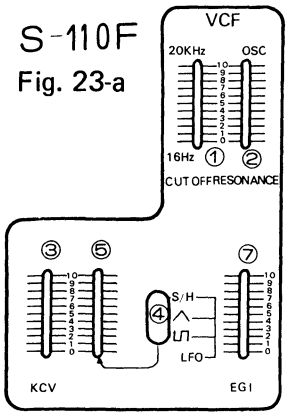
### 5 6 VCO, NOISE (S-60F only)

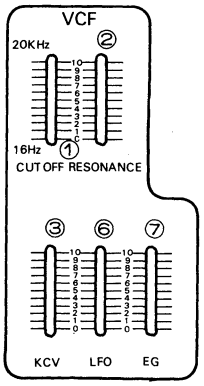
The sliders are used to adjust the output of VCO and NOISE (WHITE), respectively. The NOISE is used to produce the imitation sounds of the wind, wave, etc.

* If each slider is set 0, the lamps ▶will go out, and no sound will be sent to the sections after the mixer.

# 9. VCF

S-110F
Fig. 23-a




S-60F Fig. 23-b

The waveform to be the sound source of the synthesizer is produced by VCO, and it comes in VCF through the mixer. Here in this VCF section, the component of the harmonic tone of the waveform is cut off or emphasized to determine the timbre.

## 1 CUT OFF

This knob is used to cut off a specific frequency of the signal sent from VCO. The filters are roughly divided into L.P.F (low-pass filter) and H.P.F (high pass filter), and normally in VCF, L.P.F is used. This filter has the function of allowing low frequencies to pass and cutting off high frequencies.
The frequency in the boundary line between the pass band and the attenuation band is referred to as "cut-off frequency". (Fig. 24)

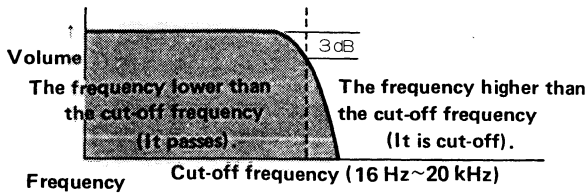



Fig. 24

The cut-off frequency of VCF can be controlled from 16Hz up to 20kHz. When the slider is raised (20 kHz), the waveform of the signal sent from VCO passes, but as the slider is lowered, the high harmonic tones of that signal will gradually be cut off, the waveform will be rounded, and the sound will be dull. When it is further lowered, the waveform will approach sine waves, the sound will be softer like that of the flute. When it is lowered furthermore, the fundamental sine wave will also be cut off, and the sound will disappear.

## 2 RESONANCE

It places an emphasis on the vicinity of the cut-off frequency set by ①. When this ② is slided upward, a specific harmonic tone will be emphasized, so that the timbre can be made characteristic.
When it is slided up to the maximum, oscillation will be caused in the vinicity of the cutoff frequency.
This oscillation is a perfect sine wave.
The volume will be lessened as the Knob RESONANCE is slided upward, so adjust the volume by means of the total volume, etc. (Fig. 14-⑨).

## 3 KCV (Keyboard Controlled Voltage)

This knob is used to control VCF by KCV (the voltage of the keyboard), Generally speaking, the timbre (harmonic tone construction) of the sound of a musical instrument changes in accordance with the pitch.
Therefore, when a different key is pressed and a different cut-off frequency is set, the tone color will be more natural.
The cut-off frequency of VCF depends on the voltage of the key. Therefore, with this knob slided UP, the tone remains unchanged regardless of which key is pressed.
On the other hand, when this knob is slided DOWN, the voltage of the key does not work to VCF and the tone changes, depending on which key is pressed.

## 4 5 LFO (S-110F only)

Select any of S/H, ( ⋀ ), ( ⊓⊔ ) of LFO on the Switch ④ to control VCF. When it is set to S/H, the cut-off frequency changes at random, and thus, a peculiar tone change can be obtained. When VCF is controlled by ( ⋀ ) or ( ⊓⊔ ), a continuous wow wow effect (growl) can be obtained. In any case, it is more effective to set the cut-off frequency in the midst position of the slide knob ① and to set the resonance knob ② in the upper position. The speed of modulation is controlled by LFO (Fig. 30-①).
The depth of moculation is adjusted by the slider ⑤.

## 6 LFO (S-60F only)

VCF can be controlled by the knob LFO. The waveform and S/H can be set by the select switch (Fig. 30b-③) of the LFO block. The effect is same as that of ④ ⑤ of S-110F.

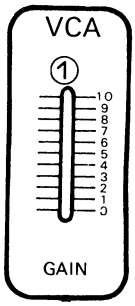
## 7 EG of S-60F/EGI of S-110F (Envelope Generator)

VCF can be controlled by the knob EG (EGI). As for the harmonic tone construction of the signal sent from VCO, the timbre changes in course of time according to the pattern determined by EG (EGI) bank. This is also the effect for bringing one tone nearer to the natural sound of musical instruments by changing it in course of time, as described in the "Understanding Synthesizer Basics 3 ".
Generally speaking, it is more effective to lower the cut-off frequency when VCF is controlled by EG (EGI).

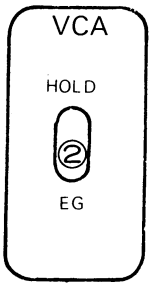
* The lighting of the lamp ▶ toward VCA depends upon the harmonic tones contained in the signal which is passing through VCF.

* The method of modulation of each of the above corresponds to Figs. 19 and 20 of the VCO bank already described. In the case of VCF, however, the pitch does not change, but the timbre changes.

# 10. VCA, Filter Bank and HPF




S-110F
Fig. 25-a




S-60F
Fig. 25-b

**(1) VCA (Voltage Controlled Oscillator)** refers to an amplifier which is controlled by voltage. The amplifier has the function of increasing the level of signal, and the signal sent from VCO and VCF is changed by the control voltage. The change of the volume in the attack and decay of the sound of a musical instrument is caused by controlling VCA by the voltage which is patterned by the envelope generator (EG, EGII) to be described later.

### 1 GAIN (S-110F only)

To control VCA by EGII, slide the knob down. As it is slided up, the signal from VCO and VCF will be less changed, and when it is slided up to the full, the signal will pass through VCA. (The sound will be issued all the time.)

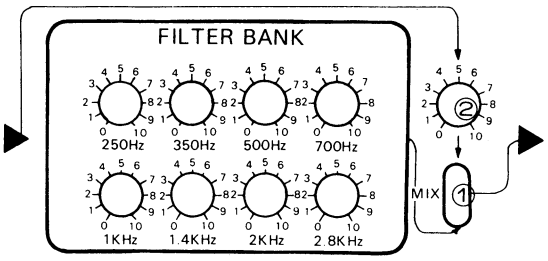
When the trigger select switch of the EG BANK (Fig. 31-a) is set to LFO, the periodical change of the volume (amplitude modulation) can be obtained, and thus, the tremolo effect can be caused. (Fig. 6-b)

### 2 HOLD/EG (S-60F only)

When it is set to HOLD, the signal from VCO and VCF will pass through VCA, so the sound will be emitted all the time. When it is set to EG, the volume change of the pattern set by EG can be obtained every time a key is pressed.

### (2) Filter Bank (S-110F only)

S-110F is equipped with a fixed filter bank of 8 points. The format of up to +25 dB can be caused at 250, 350, 500, 700, 1,000, 1,400, 2,000 and 2,800 Hz. respectively. (Fig. 27)




S-110F Fig. 26

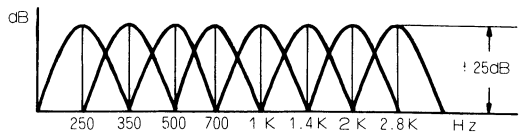



Fig. 27 Filter Bank

### 1 2 Selector and MIX Knob

Set the selector ① to the UPPER position to issue the signal only of VCA, to the MIDDLE position (MIX) to issue the signal of VCA and the signal which has passed through the filter bank, and to the LOWER position to issue only the signal that has passed through the filter bank.

Adjust the balance of both signals by the knob ②.

When ① is set to the upper position and ② is set to 0, no sound will be emitted. Therefore, no signal will be sent to HPF and the lamp ▶will not light on.

### 3 HPF (High-pass filter)

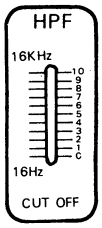



Fig. 28

LPF has been described in the paragraph describing the VCF bank, and HPF functions inversely. That is to say, HPF has the function of cutting off low frequencies and allowing high frequencies. (Fig. 29)

The cut-off frequency can be controlled from 16Hz up to 16kHz.

When the knob is set in lower position, the timbre changes little, while the low compass will be cut-off as it is slided up, so the sound will be brighter and more brilliant. However, as the volume will be lessened as it is slided up, control the volume by the total volume, etc. (Fig. 14-⑨). This HPF is effective above all for creating the sound of the musical instrument such as trumpet, etc. which contains a comparatively small amount of fundamental waves.

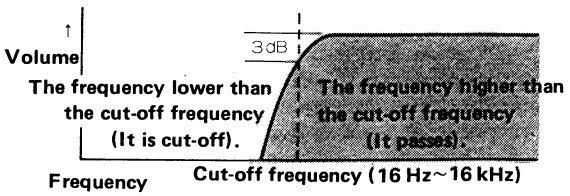
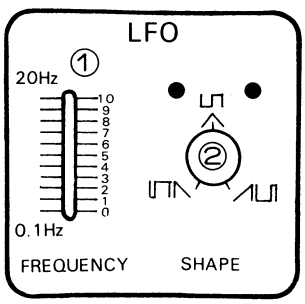
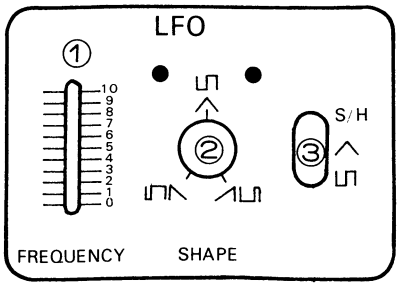



Fig. 29

# 11. LFO




S-110F Fig. 30-a




S-60F Fig. 30-b

The low frequency oscillator produces the signal to control VCO, VCF, VCA, etc.
It oscillates between 0.1 ~ 20 Hz. and it has the function of causing a variety of such the effects as described in the preceeding paragraphs.

## 1 FREQUENCY

It determines the oscillation frequency of LFO. As described above, it can control oscillation from 0.1 time through 20 times per second. The more it is lifted up, the more the oscillation frequency will be.

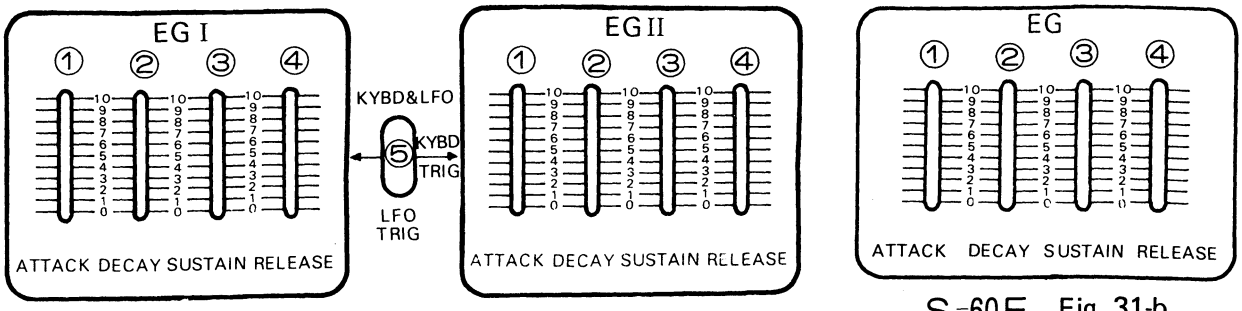
## 2 WAVE FORM

It can change the output waveform of LFO. When it is set in the center ( ⊓ ), oscillation is performed periodically. When it is set to the left or right side (⊓╲ or ╱⊓ ), the output waveform can be varied continuously, and the variation is indicated by the lighting of the two lamps located on the select knob. When DELY VIB is used, set this knob in the center.

## 3 Modulation Waveform Select Switch (S-60F only)

Select any of the positions (S/H, ╱╲, ⊓) to apply frequency modulation on VCO or to control VCF by LFO.
For its effect, refer to the paragraphs on VCO banks 15 and 16 already described and to the paragraphs on VCF banks ④, ⑤ and ⑥.

# 12. EGI & EGII




S-110F Fig. 31-a

S-60F Fig. 31-b

The change of sound in course of time and EG have already been described in the paragraph on the "Understanding Synthesizer Basics (3)". They will be described again in the following in details.
The processes of the attack and decay of the sounds of individual musical instruments differ from one another, and they vary according to the frequency (pitch). (Fig. 32-a,b,c)
In the synthesizer, this EG (Envelope Generator) causes the changes of pitch, timbre and volume in course of time after the key is pressed and the sound is emitted and until the key is released and the sound decays.
For example, the low compass of the piano contains many harmonic tones, compared with the high compass, and as the sound fades away, the harmonic tones will be decreased.
In S-110F, VCO and VCF are controlled by EGI, and VCA by EGII. In S-60F, VCO, VCF and VCA are controlled by EG.

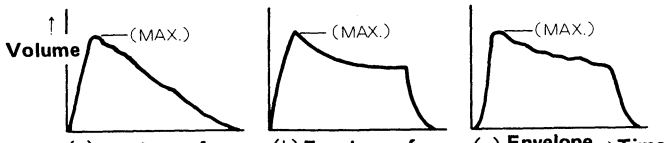



Fig. 32

## 1 ATTACK

The ATTACK slide knob on your TEISCO synthesizer permits you to adjust the attack; that is, how quickly or slowly a sound will begin and get its maximum voltage (4.5m sec ~ 5s). By sliding the knob UP, you can create a slow attack; by sliding it DOWN, you can create a fast attack.

## 2 DECAY

This knob allows you to control the decay time necessary for the voltage of a given tone to reach to its MAX and come down to a predetermined level (sustain level). (6m sec ~ 7.5s)
Therefore, the sustain level is as high as MAX, the decay cannot be changed. When both knobs of DECAY and SUSTAIN are leveled at 0, the voltage (sound) is generated only a moment.
By sliding the knob UP, the tone will decay very slowly; slide it DOWN, and the tone will decay very quickly.

## 3 SUSTAIN

The SUSTAIN slide knob makes it possible for you to control the amount of the sustain which continues after the voltage of a given tone has reached to its MAX. While a key is pressed, the same level will be kept. By sliding the knob UP. You will get a longer sustain; slide it DOWN and you will get a shorter sustain.

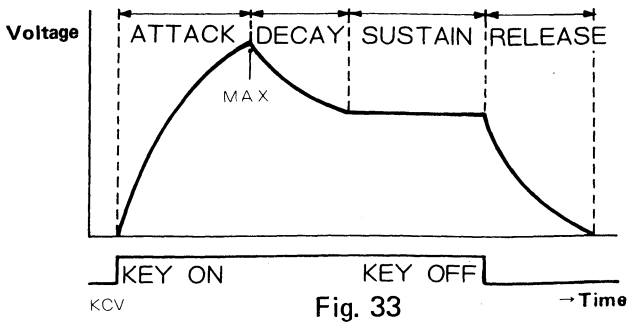



Fig. 33

## 4 RELEASE

With the RELEASE slide knob, you can control how quickly or slowly the tone will fade totally away after the key is released. By sliding the knob UP, the tone will fade away very slowly; slide it DOWN and the tone will fade away very quickly.

* In each slider of ① through ④, the higher it is lifted up, the longer the time in concern will be; the lower the slider is, the shorter the time will be.
* Even if all of ① through ④ are set to 0 and VCF and VCA are controlled, only a click noise is generated a moment.

## 5 KEY/LFO TRIGGER (S-110F only)

With this selector, you can select the signal for operating EG.

**KEYBD & LFO TRIG** . . . Only while a key is kept pressed, EG operates periodically by the signal of LFO. (Fig. 34-a)

**KEYBD TRIG** . . . EG operates every time a key is pressed. (Fig. 34-b)

**LFO TRIG** . . . EG continues to operate by the signal of LFO even if a key is kept pressed or released. (Fig. 34-c)

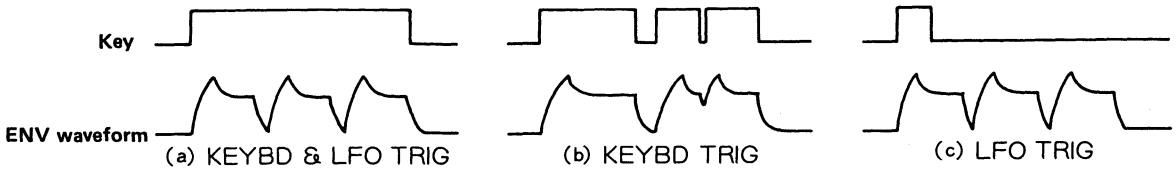



Fig. 34

# ——13. Effective Operation and Precautions——

After you have comprehended the fundamental operation of each section, you are ready to enjoy your TEISCO Synthesizer to its full. Much time is required for everybody before one can instantly create the sound as is intended. We will describe again how to operate effectively and care for your synthesizer in the following:

- **Modulation and Level LED (S-110F only)**
  Four modulation and level LEDs are provided at the upper end of the panel of S-110F. The LEDs on VCOI and VCOII indicate the depth of FM modulation of respective VCO. The LED on VCF indicates how the frequency is cut-off. If it is not lighting, the sound is mild, and if it is lighting, the sound is hard. The LED on the filter bank indicates the output of the filter bank.
  Each LED facilitates your recognition at a glimpse during your operation how your sound is created.

- **Signal Route LED ▶**
  Six lamps of S-110F and four of S-60F indicate how the signal flows. Sound is not emitted unless all of lamps ▶ light up. As each of S-110F and S-60F is so designed that the harmonic tone flows from the left to the right of the panel, it will be easy for you to find there will be a mistake in your setting in the blocks on the left side of the lamp ▶ which does not light up when no sound is emitted for all that the key is pressed.
  The lamp ▶ between the VCO bank and the mixer will not light up unless there is an input from the outside (unless this instrument is connected with another musical instrument) when the WAVEFORM switch (Fig. 16-⑥) is set to EXT IN.

- **When sound is not normally emitted:**
  At first, make sure that the power is supplied and there is no abnormality in the connection and that the power supply of the connected amplifier, volumes, etc. are normally set.
  If there is no abnormality in the connection, etc., refer once to the description on the fundamental sound emittance, and restore the setting to those shown in Figs. 9 and 10.

- **Precautions for Handling**
  Before connecting or disconnecting each cord, make sure that the power is turned off or the volume is set to 0. Make sure the same on the volume and the power supply of the amplifier of another instrument connected to your synthesizer.
  Protect your synthesizer from dust.
  If a trouble should occur, ask your dealer for repair.

# ——14. How to create fundamental sounds——

Sound is created in the following sequence: 1. Setting of sound source; 2. Setting of timbre; 3. Setting of volume; 4. Setting of effects.

1. **Setting of Sound Source**
   Make use of VCO as the sound source except when effect sound is made (NOISE is used) and when an external sound source is used (EXT IN).
   The fundamental range of S-110F and S-60F is 16' (feet). The fundamental waveform is a saw tooth shape ( ⋀ ). The setting shown in the table below is used when the sound of horn or cello is created.
   In the case of S-110F, more complicated sound is available when 2 VCO's are combined.

2. **Setting of Timbre**
   The timbre is set mainly by VCF, though EG (EGI in the case of S-110F), filter bank (only in the case of S-110F) and HPF act important parts for the purpose. To control VCF by EG, choose an appropriate example of setting from the table below or the registration guide and set EG (EGI). Then, slide up the EG (EGI) knob of Fig. 23-⑦ and slide down the cut-off frequency (Fig. 23-①) to some extent. This is because the timbre changes little in the state where the cut-off frequency is raised.
   When RESONANCE Knob (Fig. 23-②) is slided up, the sound characteristic to the synthesizer can be obtained, and with the knob lifted up to MAX, oscillation is performed.
   In addition, since KCV (Fig. 23-③) and LFO (Fig. 23-④, ⑤, ⑥) are important points for the setting of the timbre, set each of them, referring to the description on VCF. LFO above all is effective for causing the growl effect of the wind instrument.

### 3. Setting of Volume

The volume is set by VCA. If it is set to HOLD (the slider is set to MAX in the case of S-110F), sound will be emitted all the time.

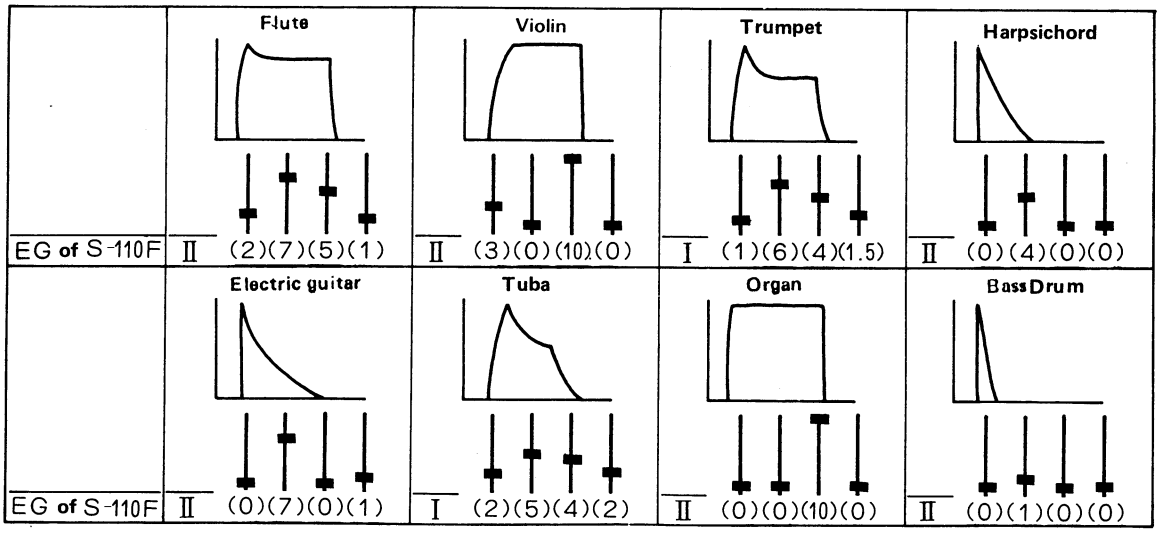
In the case of S-110F, VCA can be controlled by EGII. In almost all the cases, the envelope setting same as that of VCF is valid. It is more effective, however, to set EGII to the envelope in the shape of ⎍ (A=0, D=0, S=10, R=2) to create the envelope of a brass such as a trumpet. For further details, refer to the registration guide.

### 4.

After completion of the above-described setting, make sound characteristic by making the most of the modulation by LFO, etc., DELAY BIV. portamento, touch sensor, and so on.

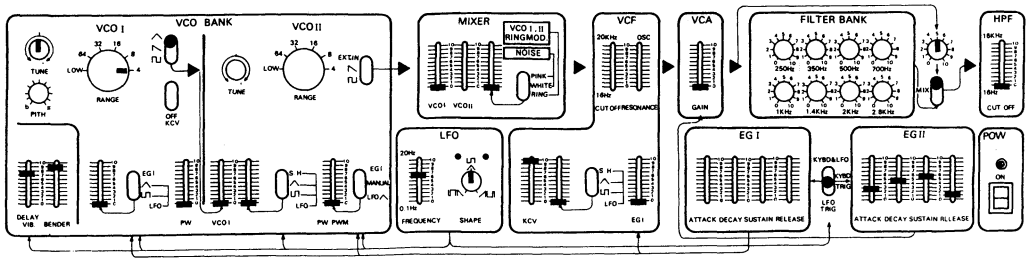
Portamento, BENDEER, touch sensor, etc. are very effective when they are used at the important points of performance.

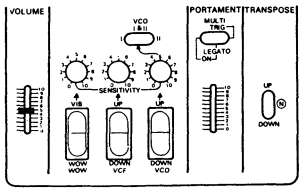
| Waveform / Range | (S-110Fのみ) | | | | |
|---|---|---|---|---|---|
| 4′ | Whistle | —— | —— | —— | —— |
| 8′ | —— | Violin | —— | —— | Flute |
| 16′ | Clarinet | Trumpet Horn and Cello | Clarinet | Harpsichord | Accordion |
| 32′ | —— | Trombone | —— | Saxophone | Electric guitar |
| 64′ | —— | Tuba | —— | —— | Bass guitar |



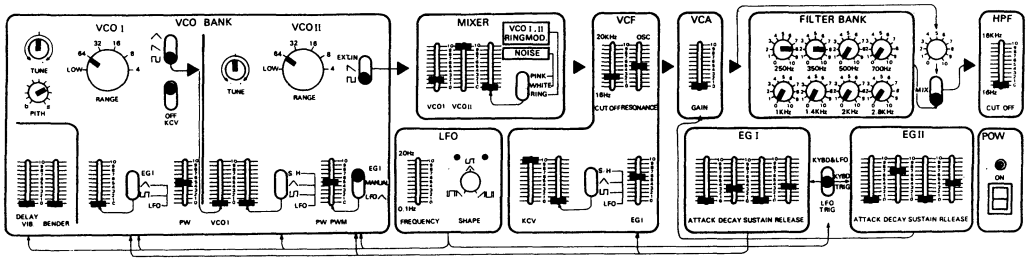
# 15. Registration Guide S-110F

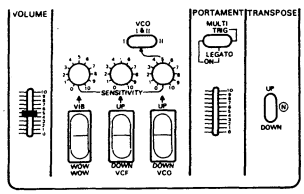
## 1 Whistle



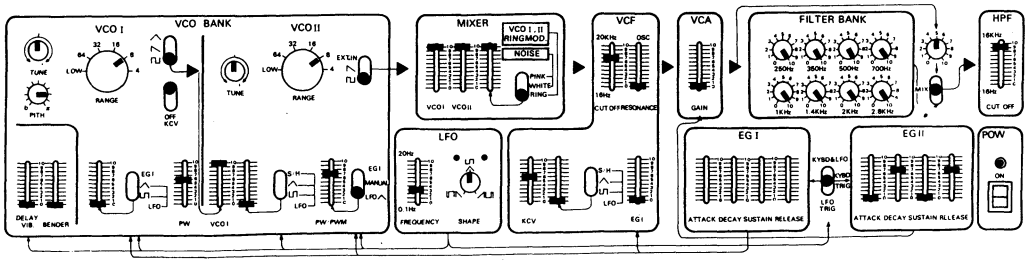



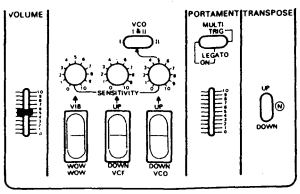

## 2 Bell



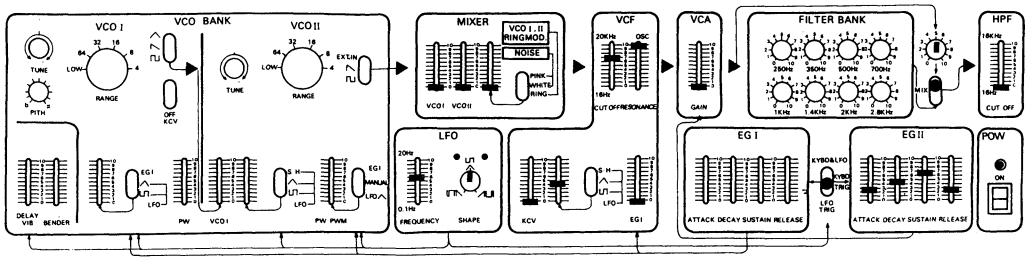



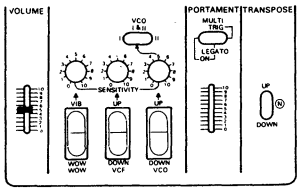

## 3 Ring



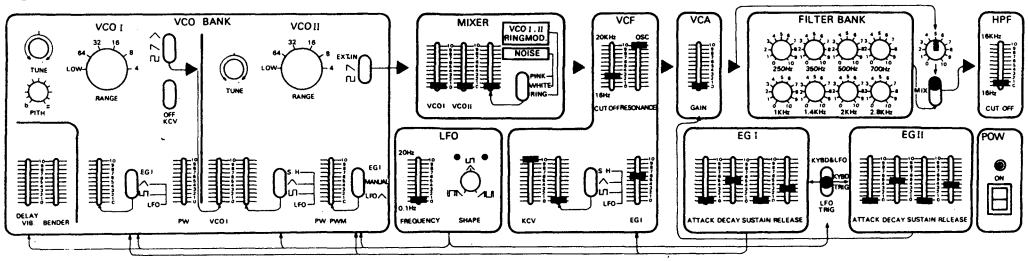



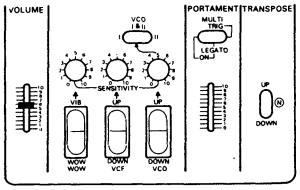
# 4 Bird



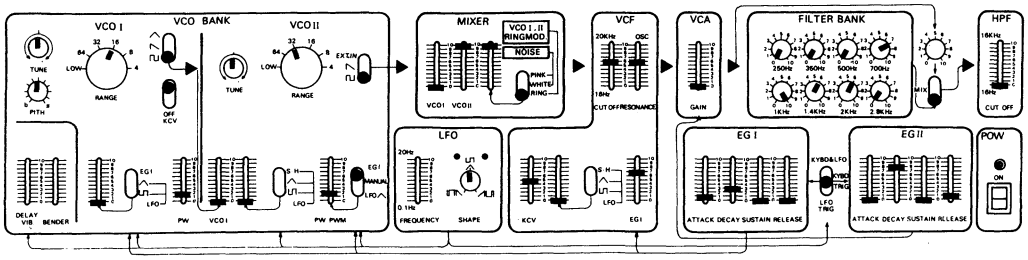



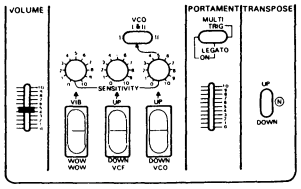

# 5 Synthe-Drum



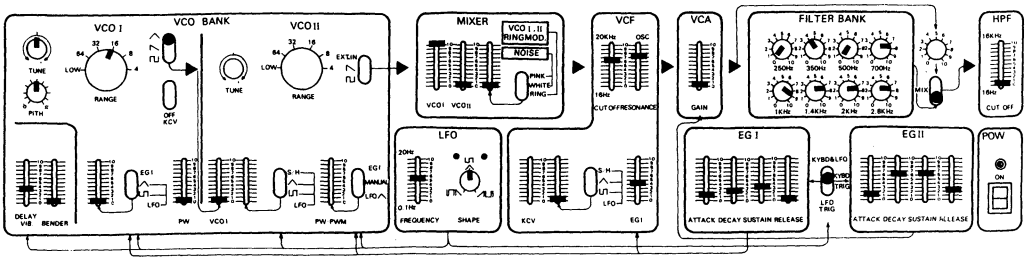



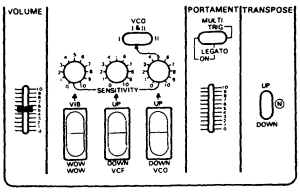

# 6 Electric guitar



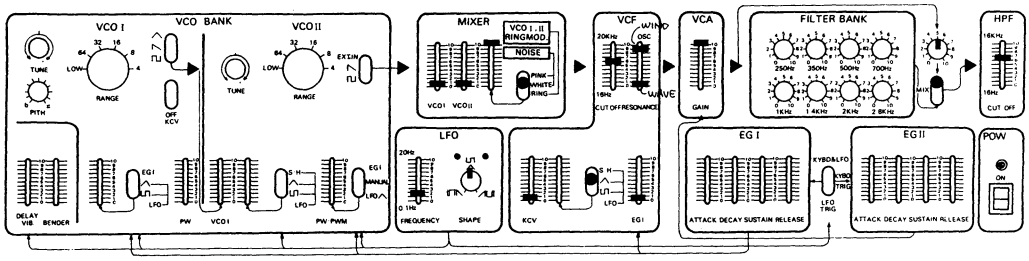



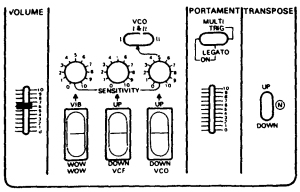
# 7 Clarinet



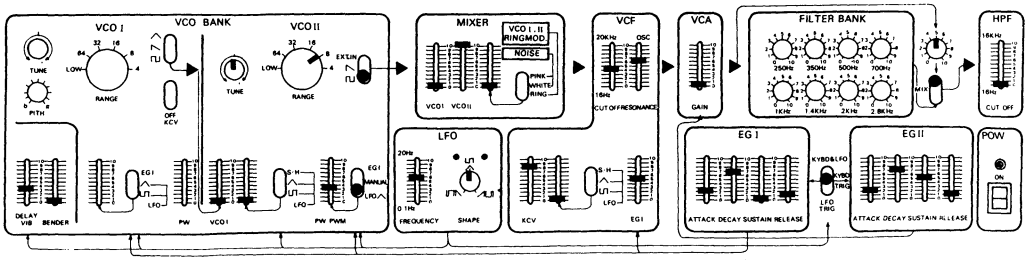



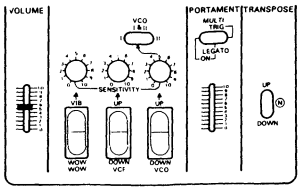

# 8 Wind blowing & Ebb tiding



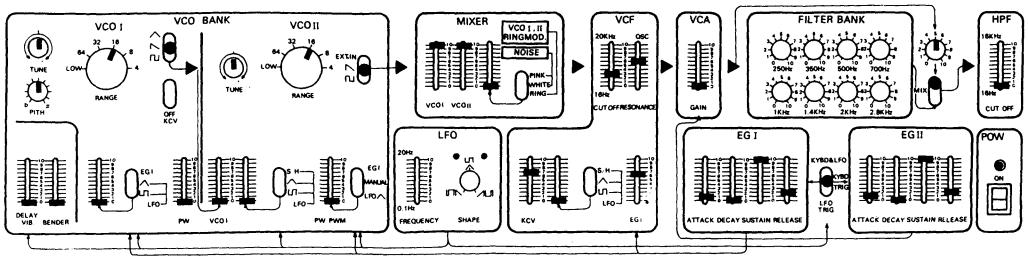



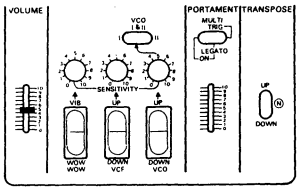

# 9 Flute



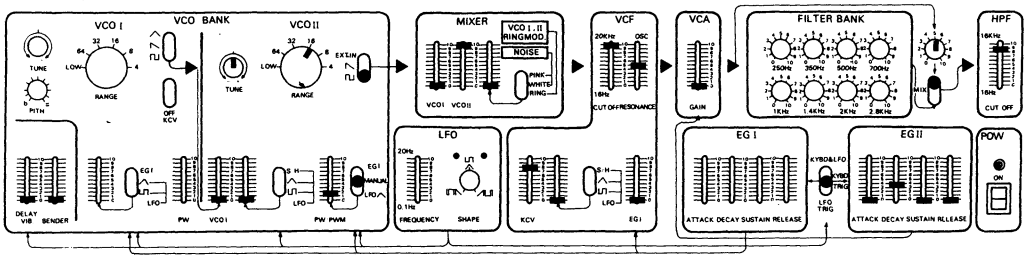



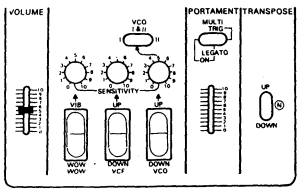
# 10 French Horn



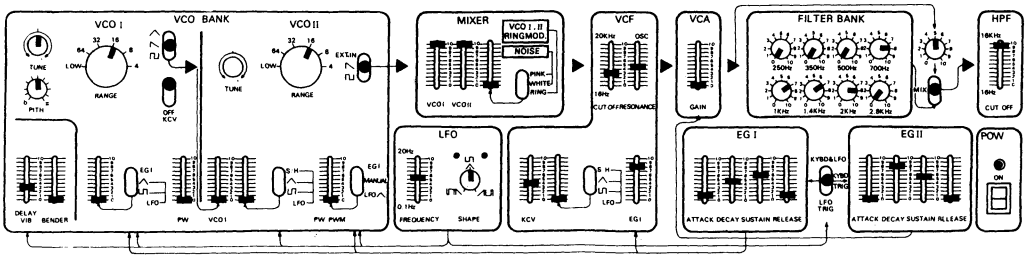



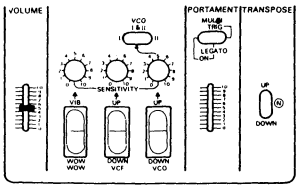
# 11 Harpsichord



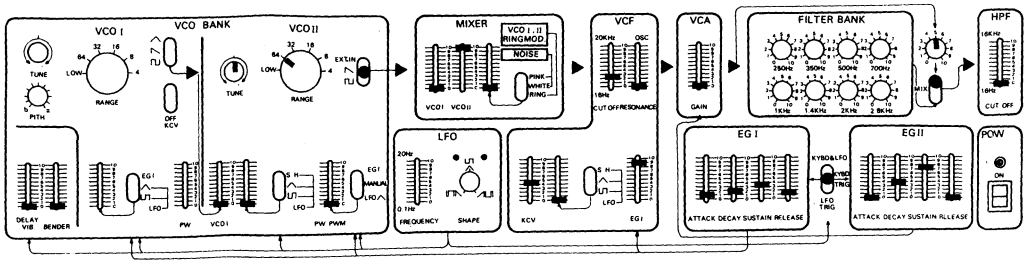



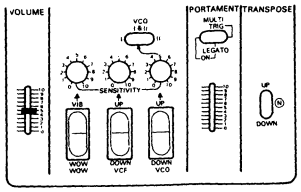
# 12 Trampet



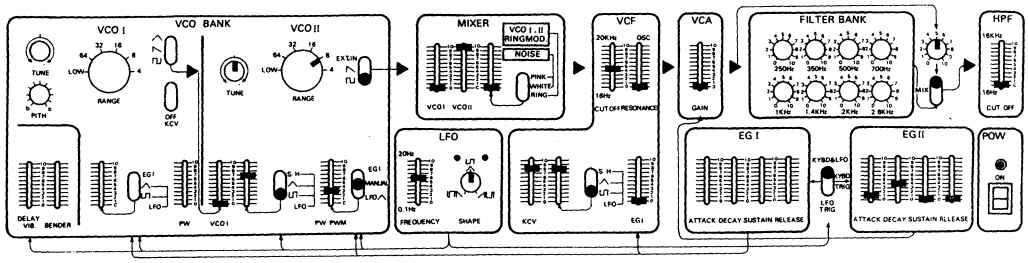



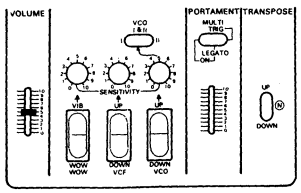
# 13 Tuba



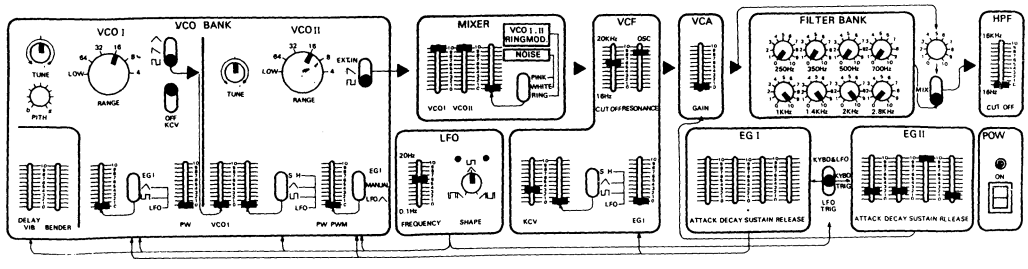



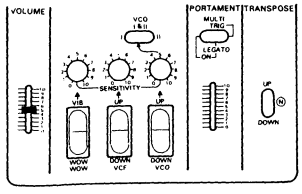

# 14 Marimba



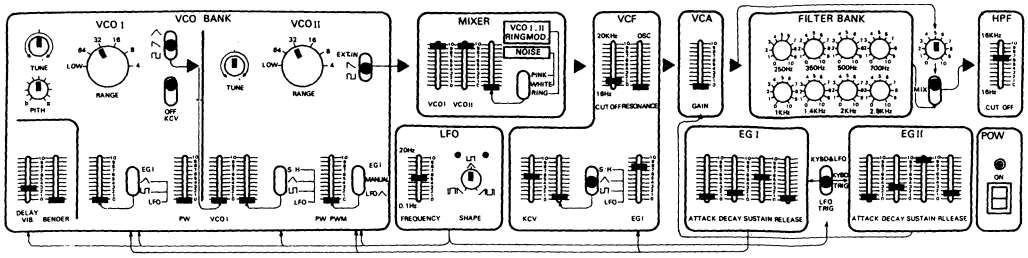



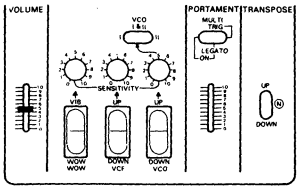

# 15 Human Voice (Choir)



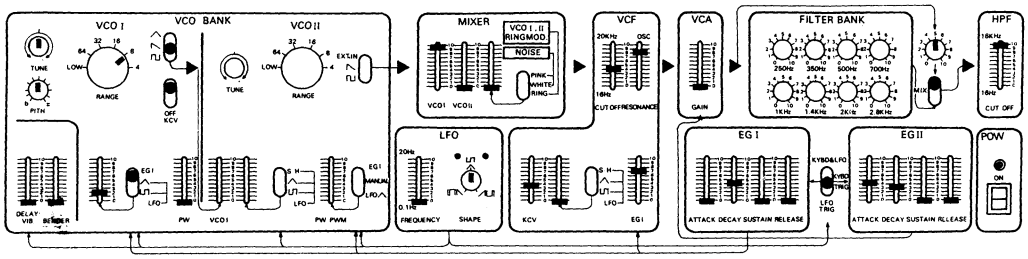



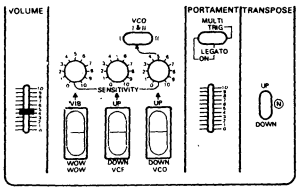
# 16 Trombone



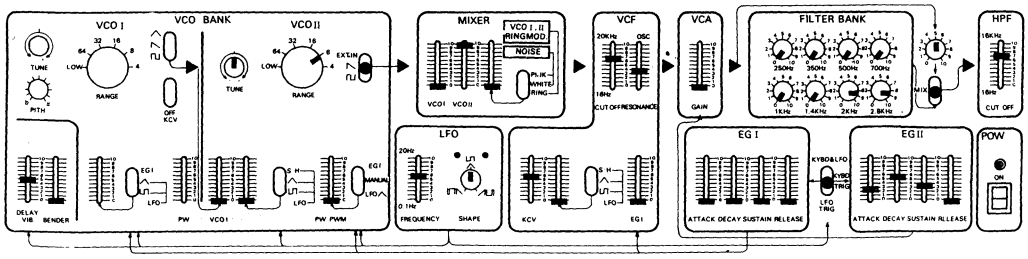



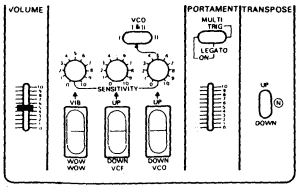

# 17 Cat mewing



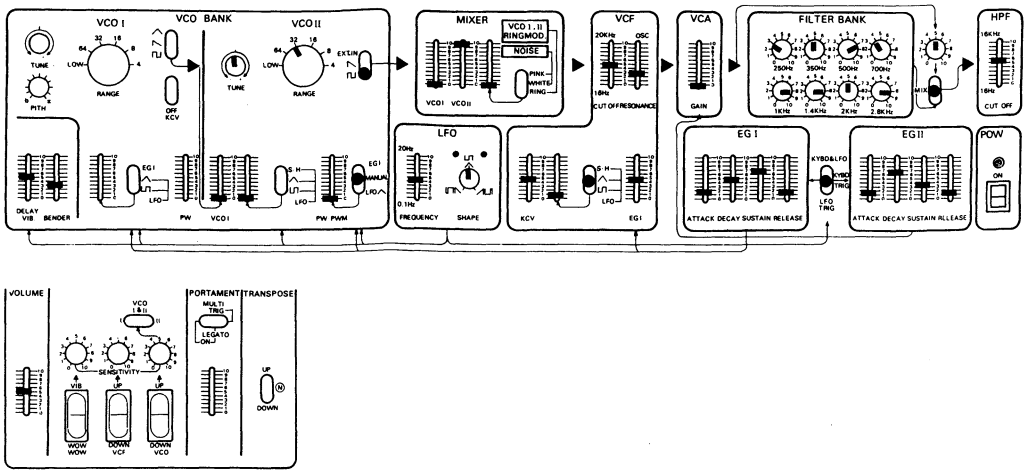




# 18 Violin

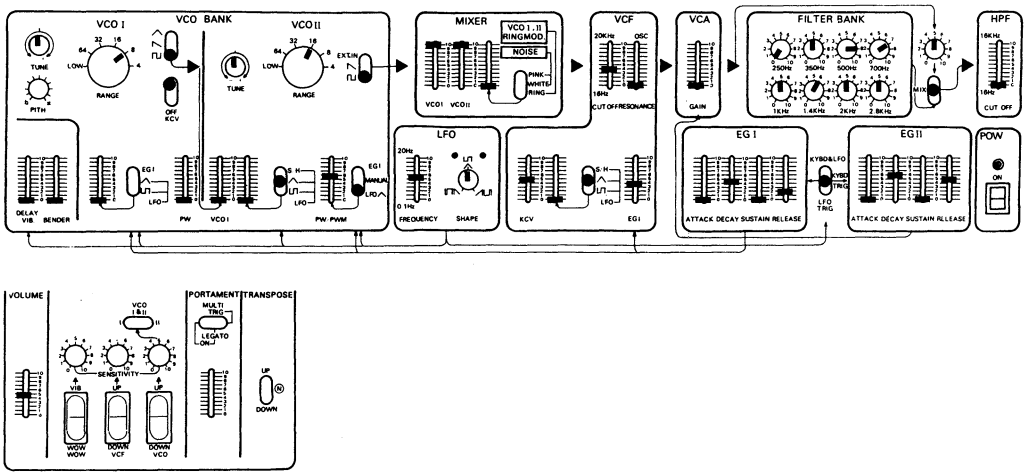


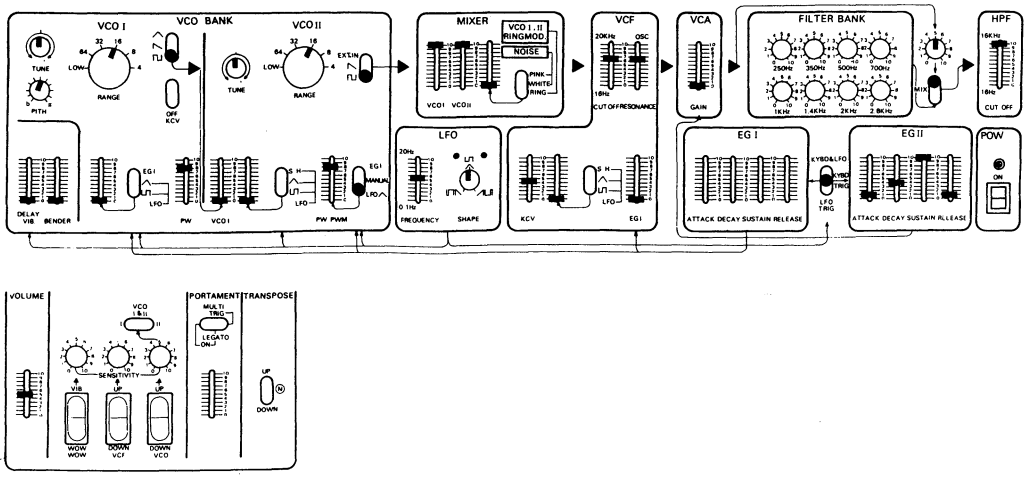
# 19 Saxophone



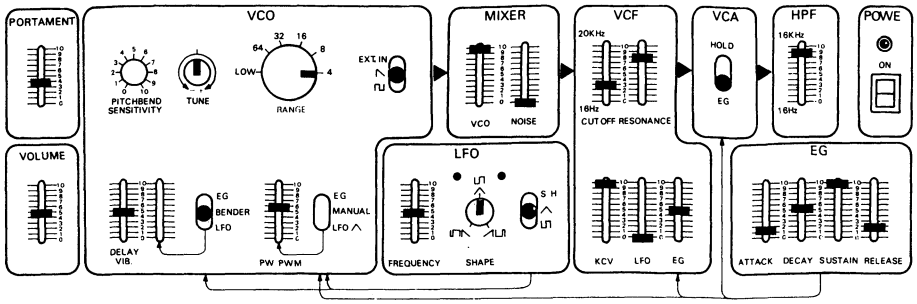

# 20 Piano



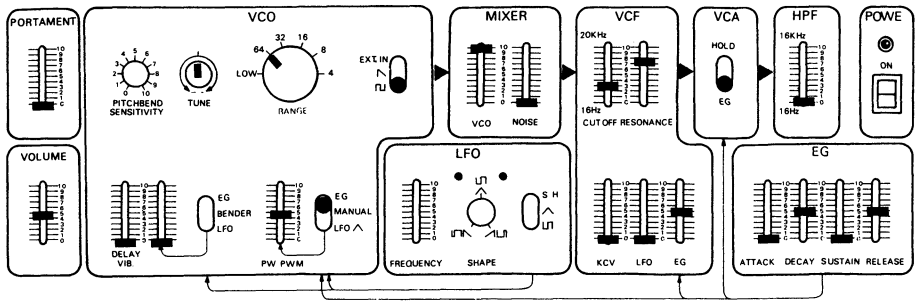

# 21 Accordion



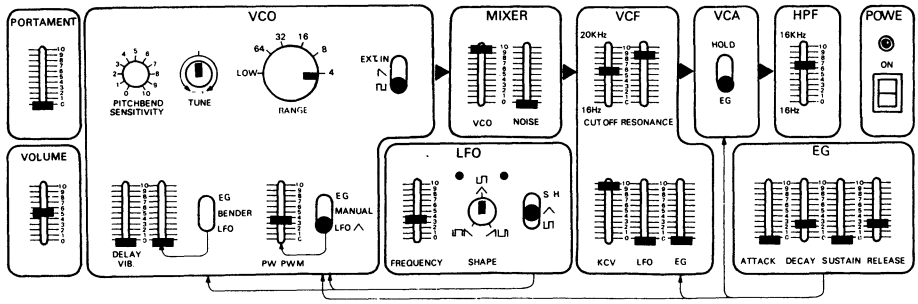
# 1 Whistle



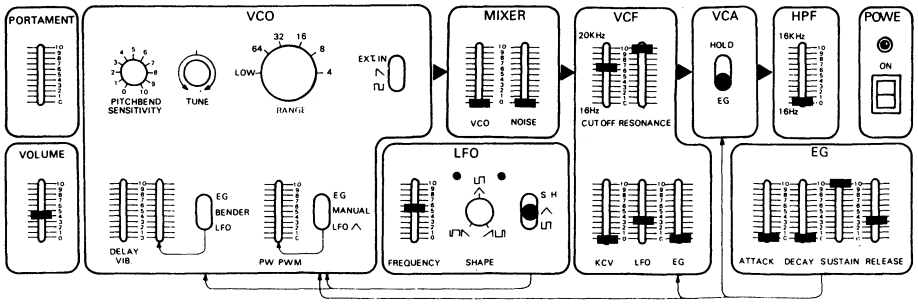

# 2 Electric bass



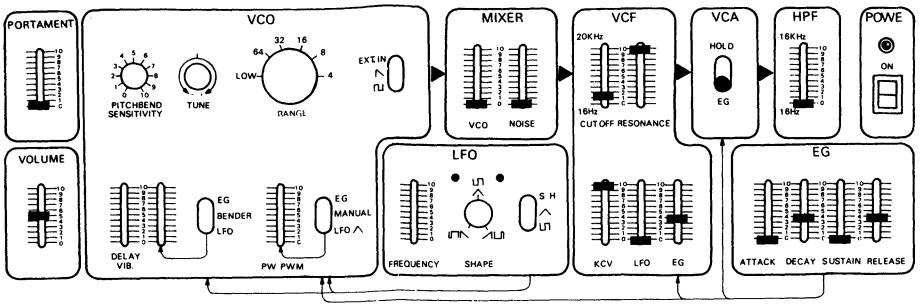

# 3 Triangle



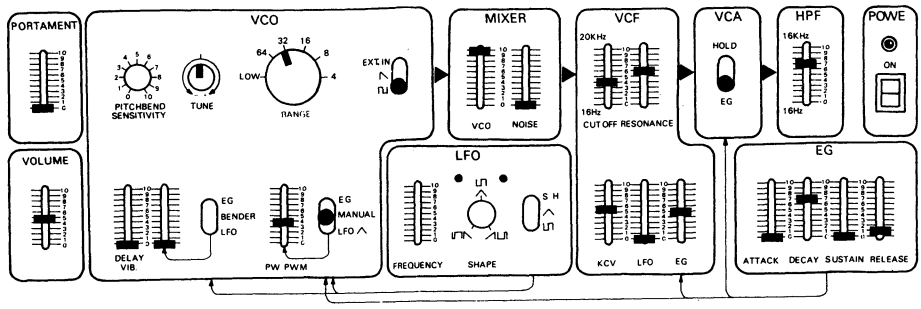

# 4 Bird calls



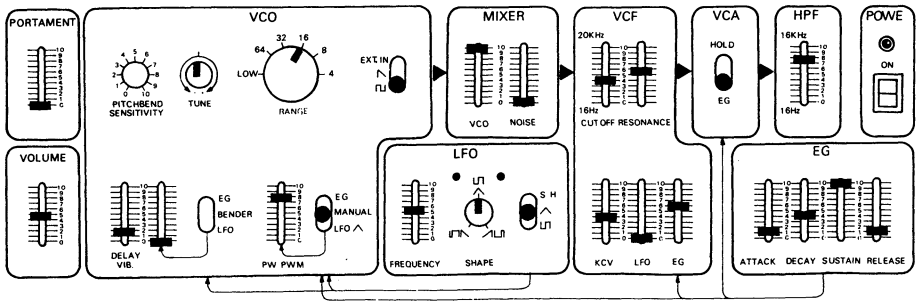
# 5 Synthe-Drum



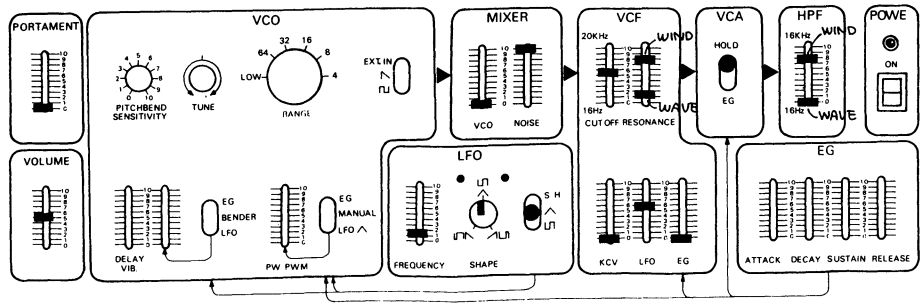

# 6 Electric guitar



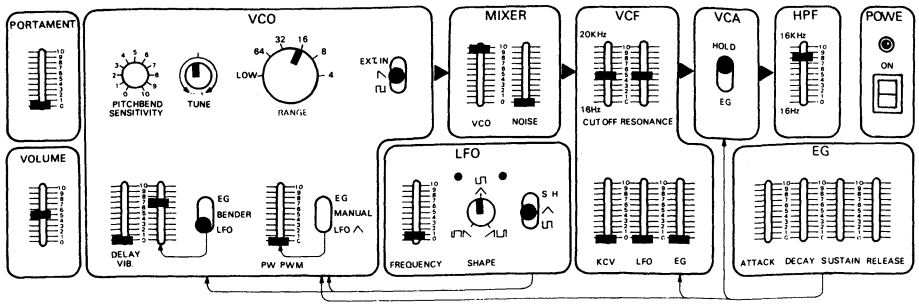

# 7 Clarinet



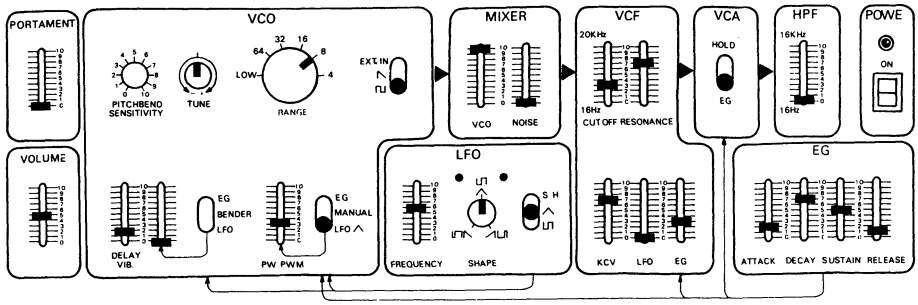

# 8 Wind blowing & Ebb tiding



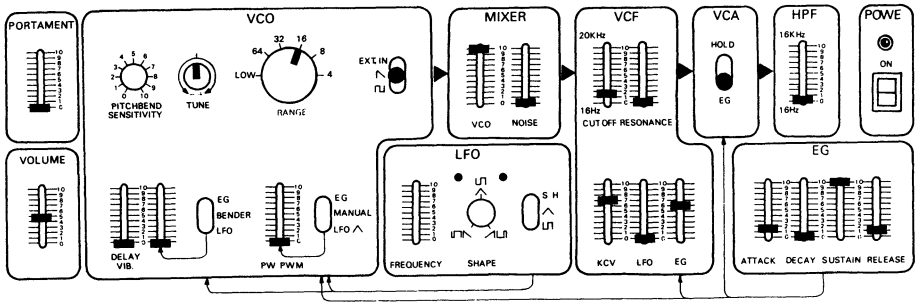
# 9 Siren



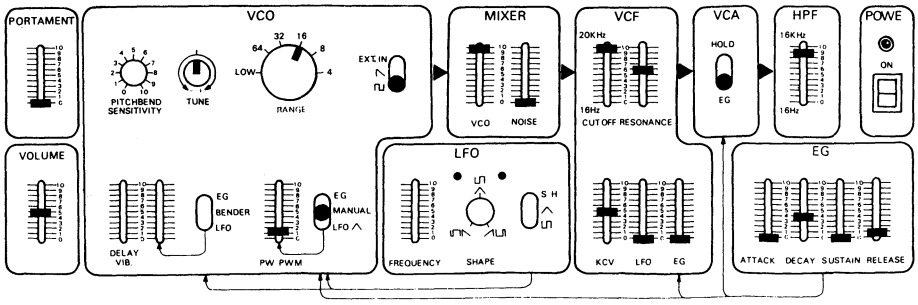

# 10 Flute



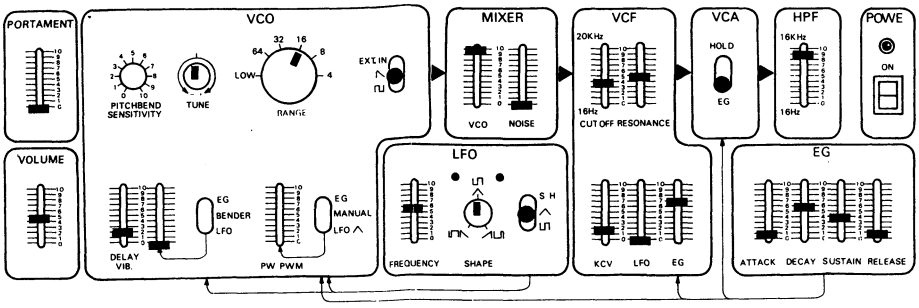

# 11 French Horn



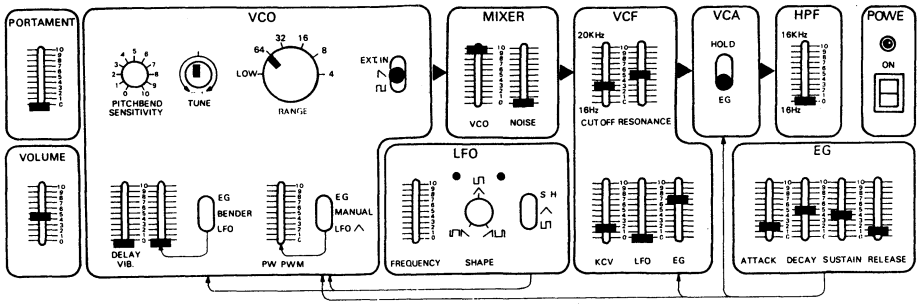

# 12 Harpsichord



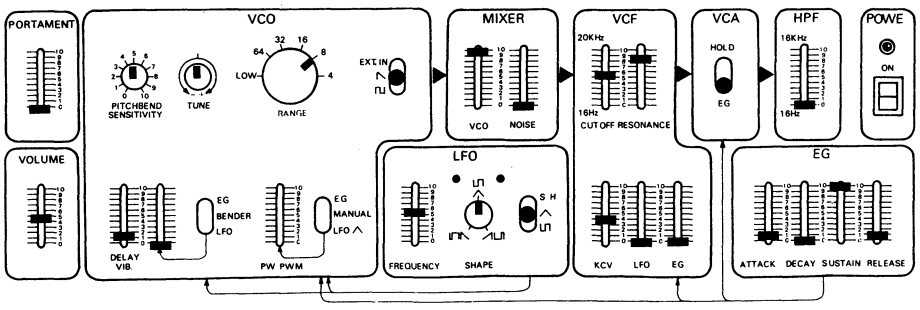
# 13 Trampet



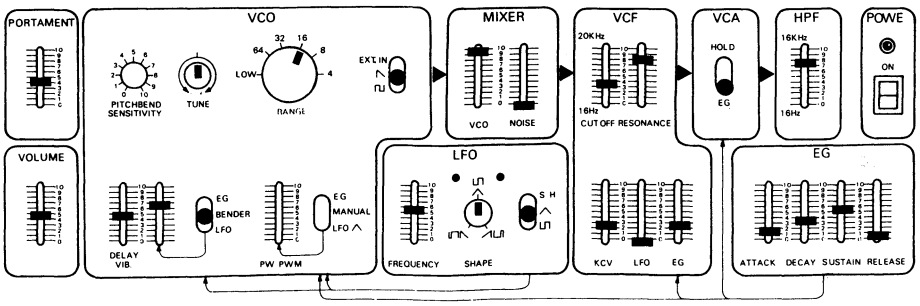

# 14 Tuba



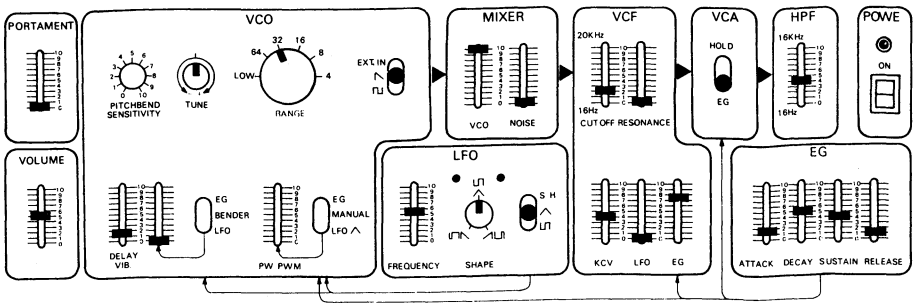

# 15 Oboe



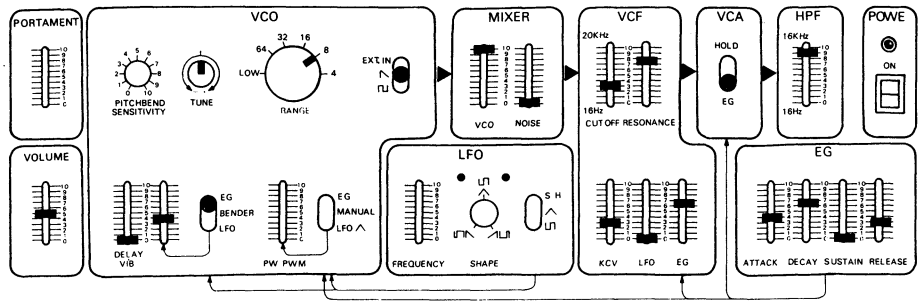

# 16 Human Voice (Choir)



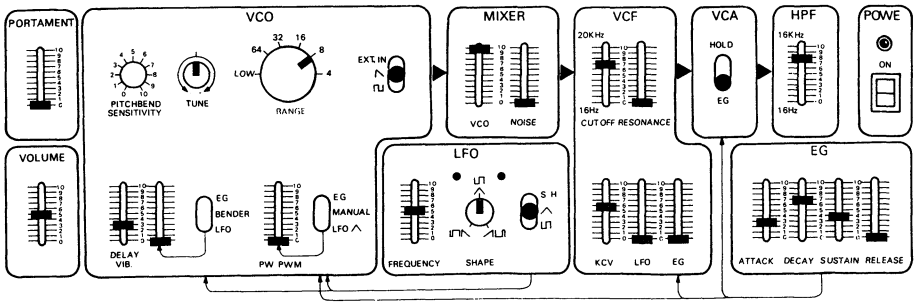
# 17 Trombone



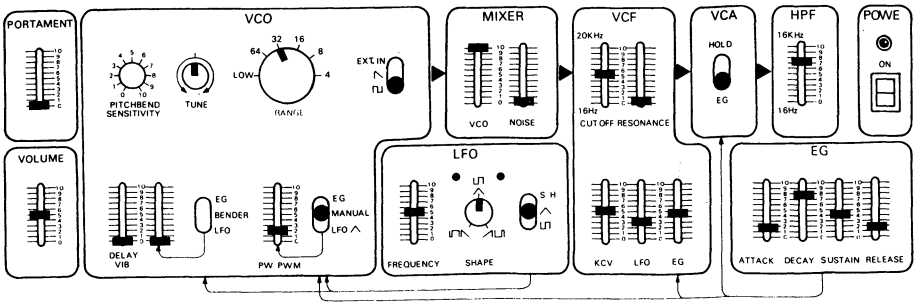

# 18 Cat mewing



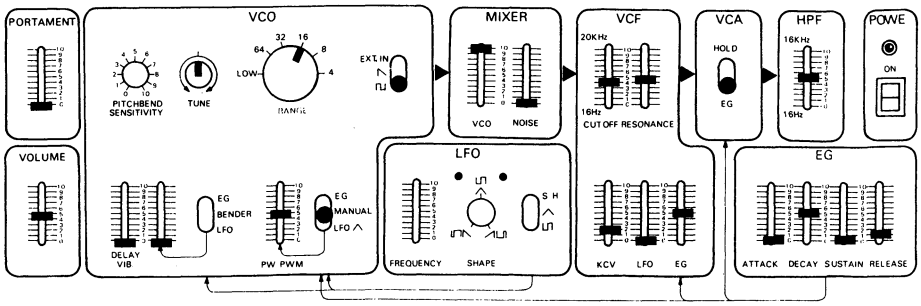

# 19 Violin



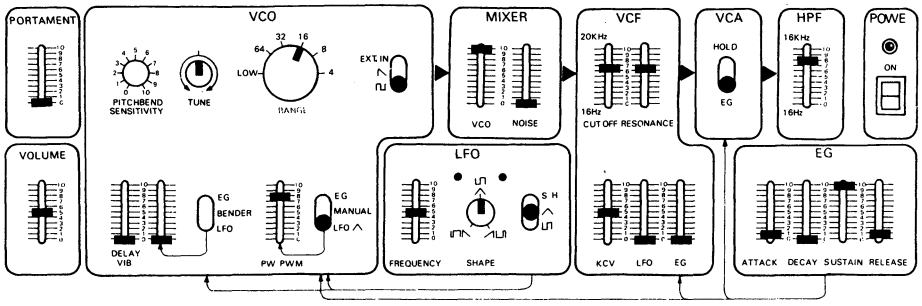

# 20 Saxophone



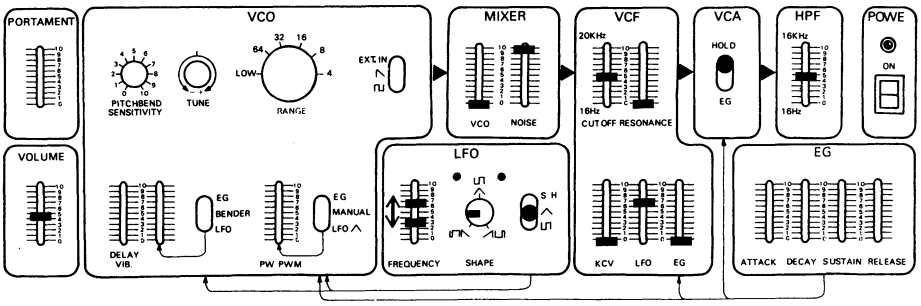
# 21 Piano



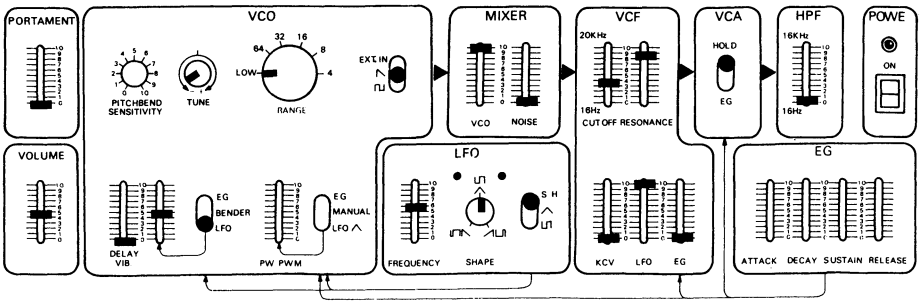

# 22 Accordion

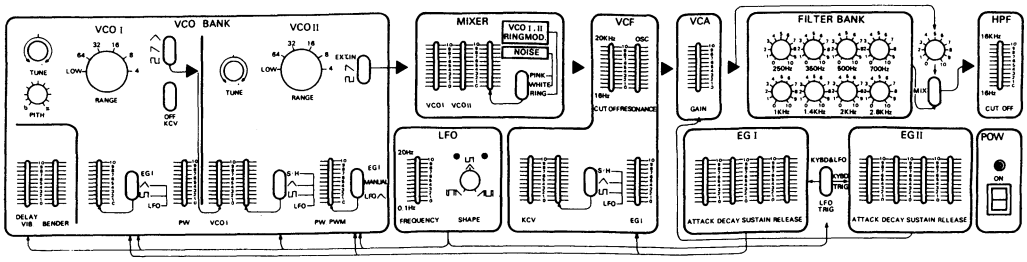


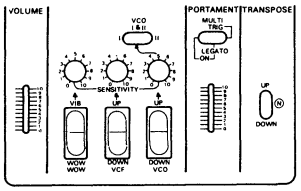

# 23 Steam locomotive

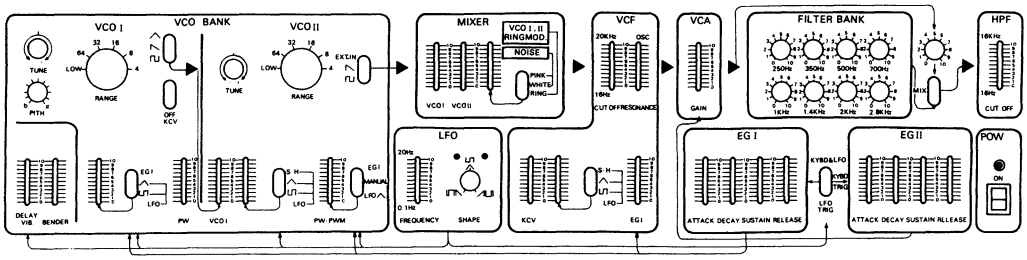


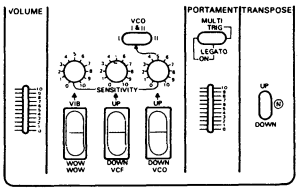

# 24 Rain dropping

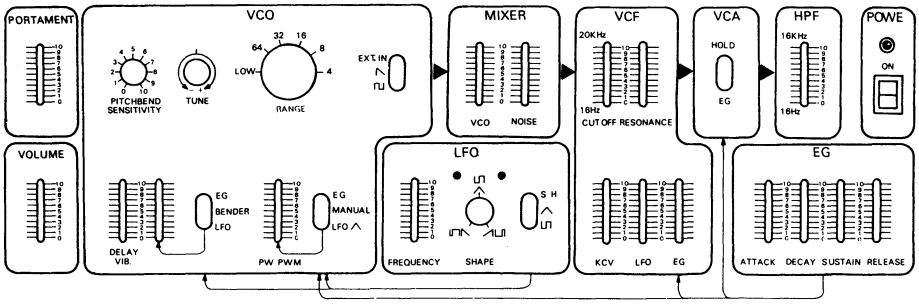


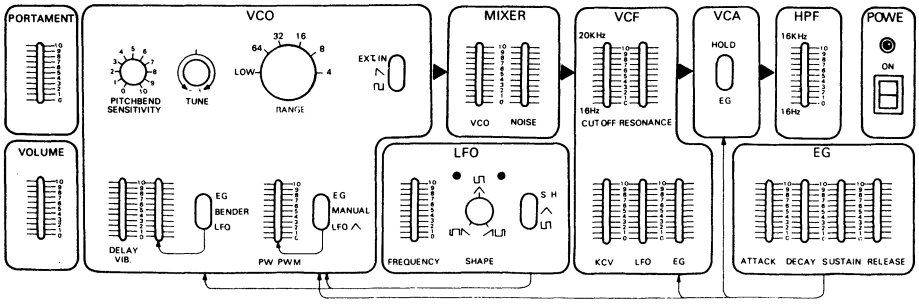

VCO I
VCO BANK
VCO II
MIXER
VCF
VCA
FILTER BANK
HPF
LFO
EG I
EG II
POW


VOLUME
PORTAMENT
TRANSPOSE

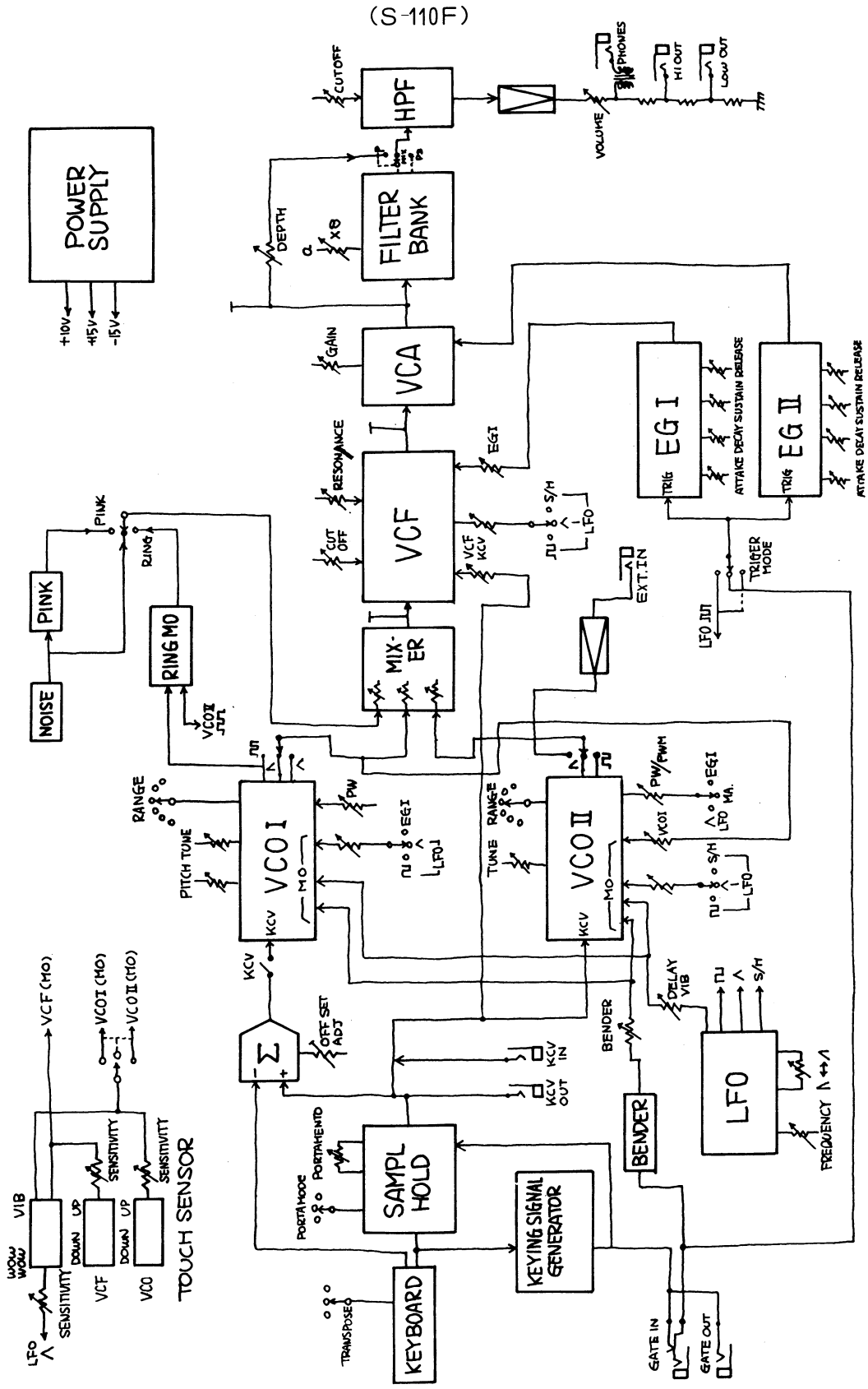

VCO I
VCO BANK
VCO II
MIXER
VCF
VCA
FILTER BANK
HPF
LFO
EG I
EG II
POW

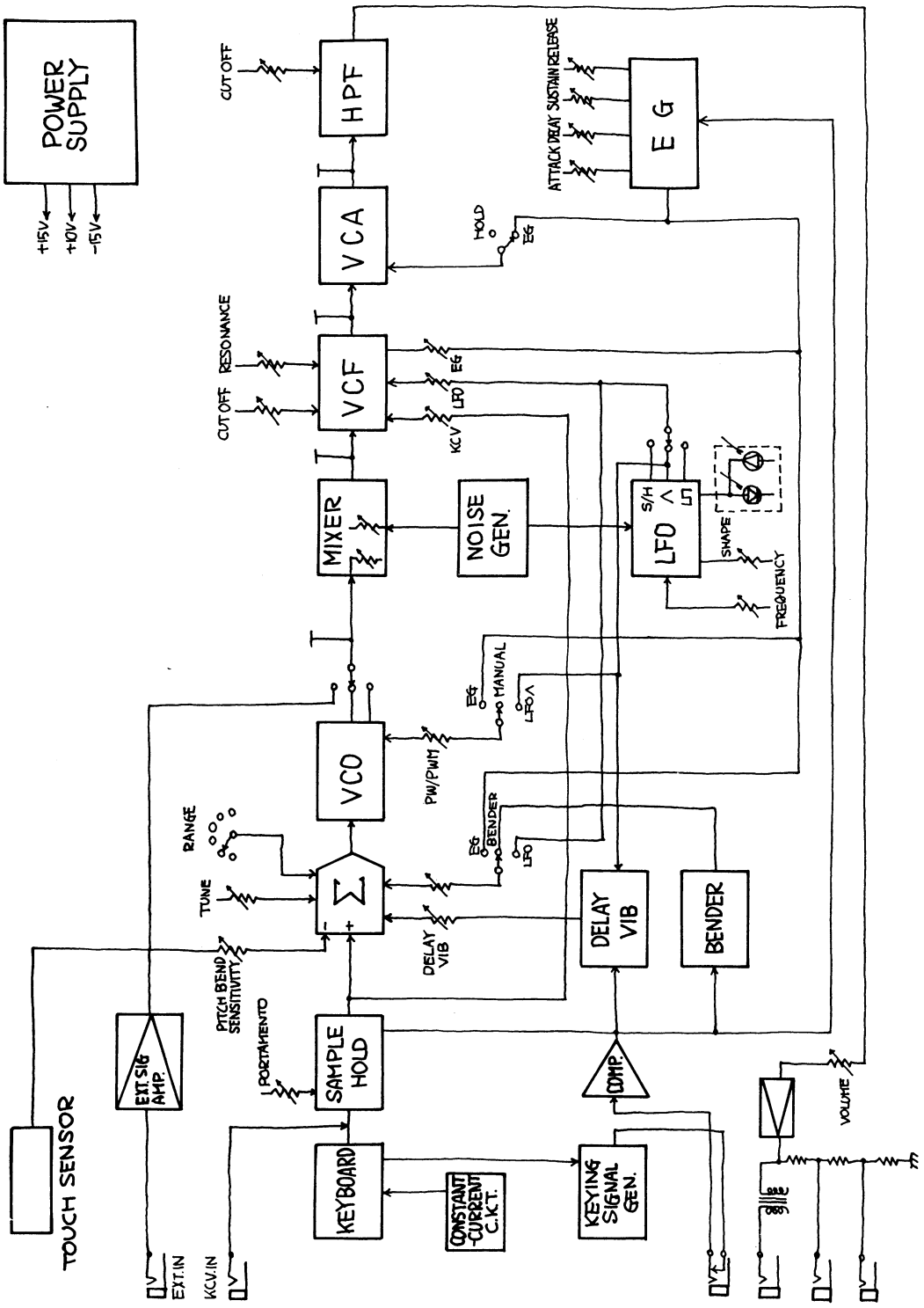

VOLUME
PORTAMENT
TRANSPOSE


PORTAMENT
VOLUME
VCO
MIXER
VCF
VCA
HPF
POWE
LFO
EG


PORTAMENT
VOLUME
VCO
MIXER
VCF
VCA
HPF
POWE
LFO
EG

# 16. Block Diagram and Standards



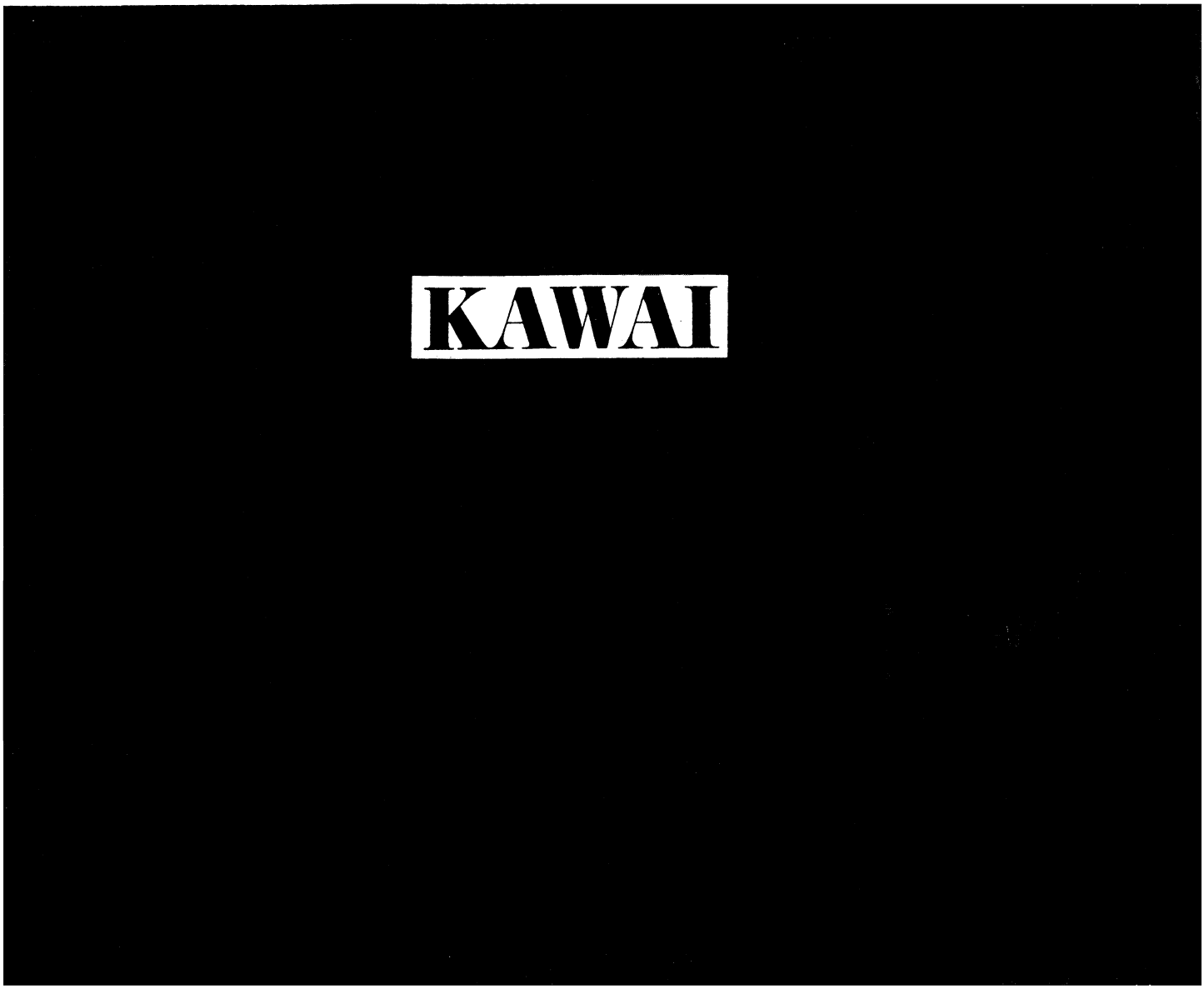

POWER SUPPLY
+15V
+10V
-15V
CUT OFF
HPF
VCA
HOLD
EG
ATTACK DELAY SUSTAIN RELEASE
EG
RESONANCE
CUT OFF
VCF
EG
LFO
KCV
MIXER
NOISE GEN.
LFO
S/H
SHAPE
FREQUENCY
EG
MANUAL
LFO
VCO
PW/PWM
RANGE
TUNE
EG
BENDER
LFO
DELAY VIB
PITCH BEND SENSITIVITY
PORTAMENTO
SAMPLE HOLD
DELAY VIB
BENDER
COMP
VOLUME
TOUCH SENSOR
EXT.SIG AMP.
KEYBOARD
CONSTANT CURRENT C.K.T.
KEYING SIGNAL GEN.
EXT.IN
KCV.IN

**S-110F specifications**

| | |
|---|---|
| Keyboard | 37 keys (C – C) |
| Type | 2xVCO, 1xVCF, 1xVCA, 2xEG, 2xVoice |
| VCO-I | Range (Low, 64', 32', 16', 8', 4'), Tune, Pitch, KCV Off, EG-I/LFO (⋀-⊓), PW |
| VCO-II | Range (Low, 64', 32', 16', 8', 4'), Tune, VCO-I, LFO (S/H,⋀ ,⊓), PW/PWM (LFO/⋀ , Manual, EG-I) |
| Mixer | VCO-I (⋀ ,⋀ ,⊓), VCO-II (EXT. IN, ⋀ ,⊓), VCO-I. II Ring Modulator/Noise (Pink, White) |
| LFO | Frequency (0.1Hz – 20Hz), Wave Shape (⊓-⊓-⊓) (⋀ -⋀- ⁄) |
| VCF | Cut-Off (16Hz – 20KHz), Resonance, KCV, LFO(S/H, ⋀ ,⊓ ), EG-I |
| VCA | Gain Control |
| Filter Bank | Frequency 250, 350, 500, 700, 1.4K, 2K, 2.8K (Hz) |
| EG-I | Attack Time, Decay Time, Sustain Level, Release Time |
| EG-II | Attack Time, Decay Time, Sustain Level, Release Time |
| High Pass Filter | Cut-Off (16Hz – 16KHz) |
| Effect Controls | Portamento (ON/Legato/Multi-Trigger), Transpose (UP/N/ Down), Sensitivity: Vib/Wow Wow, VCF (Up/Down), VCO (Up/Down), Sensitivity Level: Vib/Wow Wow, VCF (Up/ Down), VCO (Up/Down), Sensitivity Selector (VCO-I, VCO-I/II, VCO-II), Delay Vibrato Control, Bender Control, EG/LFO Trigger (Keyboard & LFO, Keyboard, LFO) |
| Input | KCV In (1V/1 oct), Gate In (On over +1V), EXT. In |
| Output | Signal Out (High, Low), Headphone Out, KCV Out (1V/1 oct), Gate Out (0–+15V) |
| Indicators (LED) | Power, Signal Way, Modulation & Level |
| Power Consumption | 10W |
| Dimensions | 855(W) x 400(D) x 110(H)m/m |
| Weight | 13Kg |

**S-60F specifications**

| | |
|---|---|
| Keyboard | 32 keys (F – C) |
| Type | 1xVCO, 1xVCF, 1xVCA, 1 xEG, 1xVoice |
| VCO | Range (Low, 64', 32', 16', 8', 4'), Delay Vibrato, Mode (EG. Bender. LFO), Tune, PW/PWM (EG. Manual. LFO/⋀) |
| Mixer | VCO (EXT-IN.⋀ .⊓), Noise |
| LFO | Frequency (0.1Hz – 20Hz), Wave Shape (⊓.⊓.⊓),(⋀ .⋀. ⁄), S/H-⋀-⊓ |
| VCF | Cut-Off (16Hz – 20KHz), Resonance, KCV, LFO Mod, EG |
| VCA | Hold, EG |
| EG | Attack Time, Decay Time, Sustain Level, Release Time |
| High Pass Filter | Cut-Off (16Hz – 16KHz) |
| Effect Controls | Portamento, Pitch Bend (Up. Down), Pitch Bend Sensitivity |
| Input | KCV In (1V/1 oct), Gate In (On over 1V), EXT. In |
| Output | Signal Out (High. Low), Headphone Out |
| Indicators (LED) | Power, Signal Way |
| Power Consumption | 7W |
| Dimensions | 560(W) x 370(D) x 100(H)m/m |
| Weight | 8Kg |

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