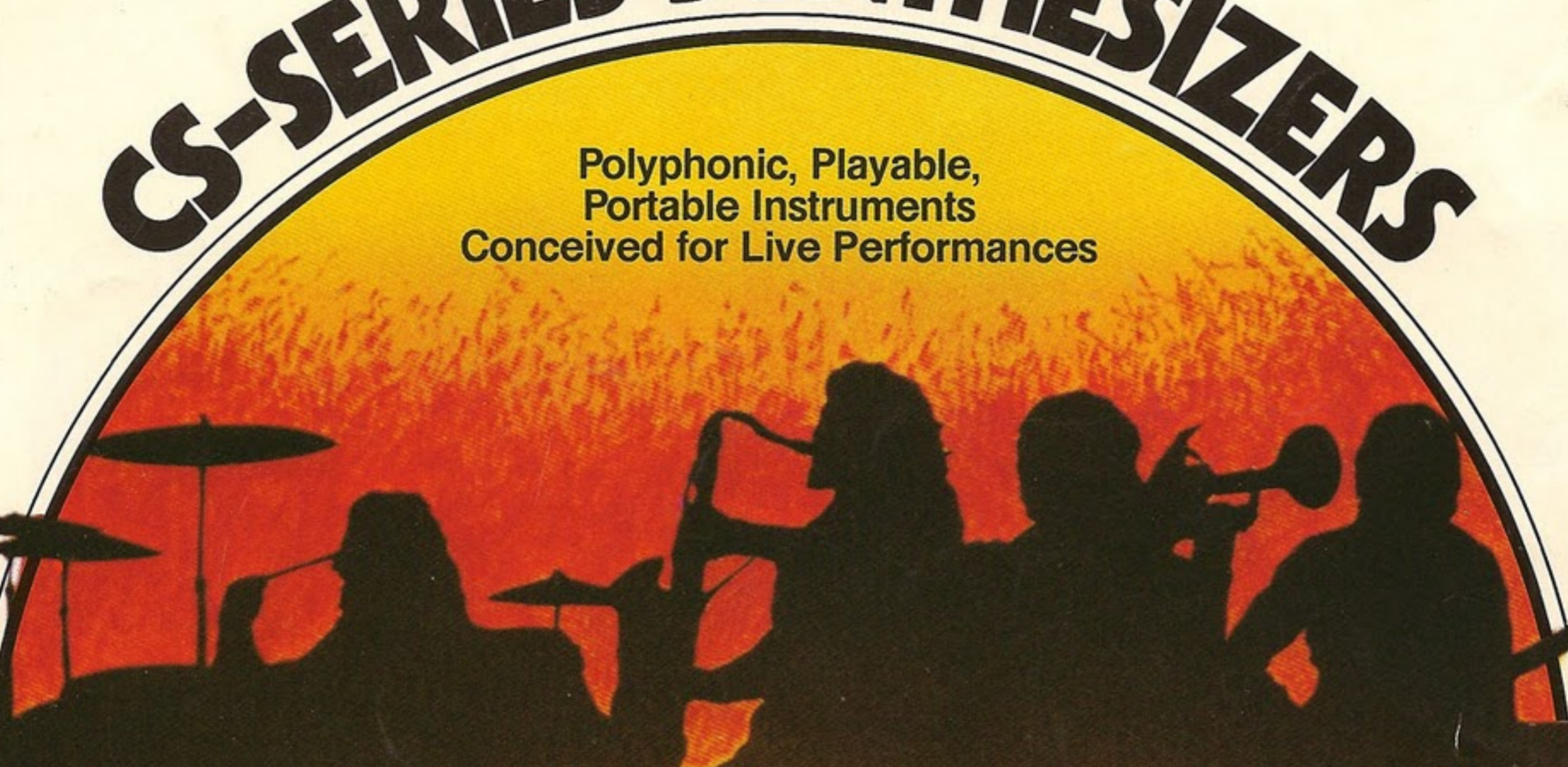# CS-SERIES SYNTHESIZERS

**Polyphonic, Playable,
Portable Instruments
Conceived for Live Performances**

CS-50

CS-60

CS-80

◆ YAMAHA

A Fascinating New Way To Create Musical Sounds

The Yamaha CS-Series of Polyphonic Synthesizers are unlike any instruments you've ever played. With their tremendous versatility, playability and portability, these advanced new instruments expand the creative abilities of any keyboard musician. All three models—the CS-50, CS-60 and CS-80—are built to the same high standards and share a common design philosophy. They differ only in certain features, as outlined in the adjacent comparison chart.

The CS-Series Synthesizers allow you to play freely because Yamaha has done away with the limitations found in previous generations of electronic music synthesizers. The CS-50 lets you play up to 4 notes simultaneously, and the CS-60 and CS-80 up to 8 notes simultaneously. Thus, you can play chords, not just a note at a time; that's what "polyphonic" means. Equally significant, Yamaha has made the CS-Series' Keyboards responsive to your touch. At last you can own a synthesizer that translates your playing dynamics into your choice of musical expression. Depending on how you play the keyboard and how you set the Touch Response controls, you can subtly add a variety of effects such as vibrato, tremolo, brilliance, volume, etc.—to individual notes, or to chords. Imagine what a difference it makes to have total control over your electronic music.

Particularly in live performances, it is convenient to be able to change sounds instantly and precisely, so the CS-Series Synthesizers are equipped with presets. The preset patches are simply built-in permanent programming for a variety of sounds, any of which may be selected at the touch of a button. At the same time, these are true synthesizers, enabling you to build a sound "from scratch." By means of a programmable panel, you select the waveform or waveforms for the basic tone (the VCO section), determine the filter characteristics to modify the tone (the VCF section), and set a volume envelope for changing the volume as a note is played (the VCA section). No longer is complex patching required. CS-Series "patches" are actually accomplished by means of simple levers and switches. What's more, each parameter—each control—is calibrated and readily adjustable, so programming settings can be duplicated accurately.

The programmable panel lets you create almost any sound imaginable, and transform a sound gradually into any other sound. Additionally, the CS-60 and CS-80 have memory panels, miniaturized versions of the standard programmable panels that may be used to store more of your "custom" sounds for instant recall.

Whether preset or programmed by the player, all sounds can be further modified with these additional functions: Sub Oscillator, Ring Modulator, Transposition, Pitch Control, Portamento, Glissando, Sustain, and overall Brilliance and Resonance. The CS-80 offers still more sound modifiers. Because the controls are clearly labeled and easy to use, you don't have to be a technical wizzard to set up a sound. When you also consider the Keyboard Control, Touch Response and Expression Pedal, you can see why the musical possibilities are literally unbounded, guided only by your imagination.

The CS-Series Polyphonic Synthesizers are third-generation products, designed and built for the performing musician by Yamaha, with over 9 decades experience in manufacturing fine musical instruments. Because Yamaha appreciates the special needs of professional musicians, the CS-Series are built with extremely reliable solid state circuitry, including digital key/note assignment and LSI "chips" (LSI=Large Scale Integration). Yamaha's generous design margins, rugged packaging and stringent quality assurance procedures are further reasons why these synthesizers endure the rigors of cartage and still keep on working from one gig to the next. In the rare event servicing is required, you can expect minimal down time because most circuit boards are plug-in modules.

Each synthesizer comes ready to play, complete with detachable legs, a music stand, an integral hard case and a comprehensive instruction manual. The manual is a valuable book in its own right, written in terms understandable by novice musicians, experienced synthesists and technicians. It explains how to use all the controls, suggests a straight-forward approach for programming any sound you want, discusses the basics of synthesizer design, provides tips on recording and live performance, and even includes instructions for building your own high-quality "direct box."

While this brochure describes the basic features of each model, there's nothing like first-hand experience. Ask anyone who's played a CS-Series Synthesizer. Better yet, see your Yamaha CS-Series Synthesizer Dealer for your own "hands on" demonstration of the CS-50, CS-60 and CS-80. They are definitely a whole new breed of synthesizers.

FEATURE COMPARISON OF CS-50, CS-60 and CS-80

This chart covers only those features which differ between models. For information about common features and specifications, see the SPECIFICATIONS chart.

FEATURE	CS-50	CS-60	CS-80
Keyboard Range	4 octaves	5 octaves	5 octaves
Simultaneous Notes	Up to 4	Up to 8	Up to 8, times two channels
Transposition	−2, −1, Normal, +1 octave shift	−2, −1, Normal, +1 octave shift	Individual channel selection of 16' 8' 4¹⁄₃' 4' 2²⁄₃' or 2' (pitch of middle C, as per organ)
Ribbon Controller	None	Pitch glide	Pitch glide
Keyboard Control	None	Brilliance	Brilliance & Level
Simultaneous Voices	1	1	2
No. of Preset Patches	13	12	22
Programmable Panels	1	1	2
Memory Panels	0	1	4
Velocity Sensitive Touch Response	None	None	BRILLIANCE** LEVEL** PITCHBEND**
Pressure Sensitive Touch Response	VCO* VCF* Brilliance Level	VCO* VCF* Brilliance Level	VCO* ** VCF* ** Speed* ** Brilliance** Level**
Tremolo/ Chorus	None	None	Yes, with Left & Right outputs for "rotary" speaker effects.
Foot Pedal	Expression	Expression	Expression & Exp/Wah
Foot Switch for Sustain & Portamento/ Glissando	None	Yes	Yes

* Causes modulation of these circuits to occur in accordance with the setting of the Sub Oscillator section.

**The CS-80 velocity and pressure sensitive effects can be produced on individual notes, notes within a chord, or the entire chord. On the CS-50 or CS-60, pressure sensitive effects are applied to all notes being played whenever one or more keys is firmly depressed.

CS-50

YAMAHA

PITCH (tuning)

Pulse Width
Modulation SPEED

PWM depth

PW duty cycle

Square wave
ON/OFF

Sawtooth
wave
ON/OFF

White NOISE

HPF
filter cutoff

RES_H "Q"

LPF
filter cutoff

RES_L "Q"

IL
(Initial Level)

AL
(Attack Level)

A
(Attack Time)

D
(Decay Time)

R
(Release Time)

VCF LEVEL

Sine Wave

A
(Attack Time)

D
(Decay Time)

S
(Sustain Level)

R
(Release Time)
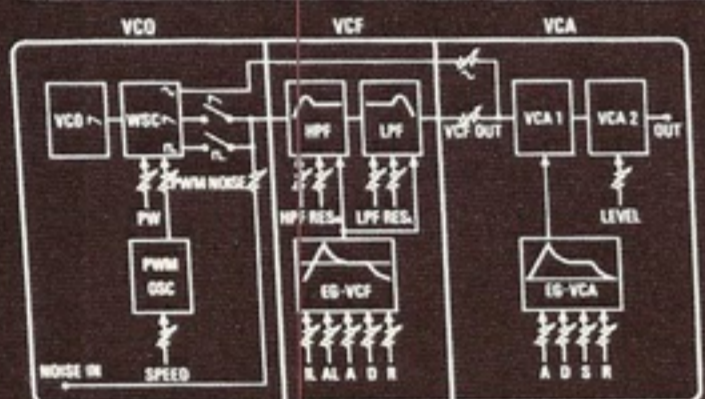
VCA LEVEL

VCO   VCF   VCA

VCO WSC

PWM NOISE

PW

PWM
OSC

NOISE IN   SPEED

HPF LPF   VCF OUT   VCA 1   VCA 2   OUT

HPF RES   LPF RES   LEVEL

EG-VCF   EG-VCA

K AL A D R   A D S R

FAST 10 50%

SLOW   0   50%   ON   ON   0

SPEED PWM PW   FL   NOISE

VCO

HIGH HIGH HIGH HIGH -5 +5 LONG LONG LONG

LOW   LOW   LOW   LOW   0   0 SHORT SHORT SHORT

HPF RES   LPF RES   IL   AL   A   D   R

VCF

10 10 LONG LONG 10 LONG 10

0   0 SHORT SHORT 0 SHORT 0

VCF LEVEL   A   D   S   R   LEVEL

VCA

PITCH

RING MODULATOR

ATTACK   DECAY   DEPTH   SPEED MODULATION
TIME   TIME

RESONANCE BRILLIANCE

TONE SELECTOR

STRING STRING BRASS BRASS FLUTE ELECTRIC CLAVI- HARPSI- GUITAR GUITAR FUNKY FUNKY FUNKY
  1   2   1   2   PIANO   CHORD   CHORD   1   2   1   2   3

TRANSPOSITION

PANEL 2 OCT 1 OCT NORMAL 1 OCT
       DOWN   DOWN   UP

TOUCH RESPONSE

SUB OSCILLATOR   VCF   BRILLIANCE   LEVEL
VCO

VOLUME

SUSTAIN PORTAMENTO GLISSANDO
1   2

FAST 10 10 10 LONG LONG

EXTERNAL
NOISE
FL

SLOW   0   0   0 SHORT SHORT
SPEED VCO VCF VCA SUSTAIN 1 PORTAMENTO
FUNCTION   SUSTAIN 2 GLISSANDO
SUB OSCILLATOR

POWER

SUSTAIN

PORTAMENTO/
GLISSANDO

SUB OSCILLATOR   RING MODULATOR   Overall BRILLIANCE   Overall RESONANCE   TONE SELECTORS   TRANSPOSITION SELECTORS   TOUCH RESPONSE   Main VOLUME   AC POWER switch
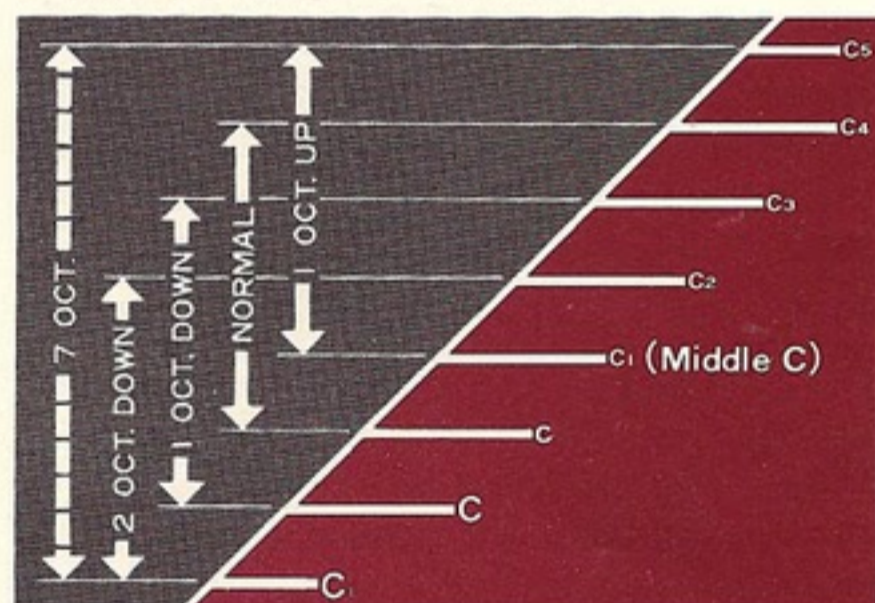
CS-50

The Keyboard and Related Features

The CS-50 keyboard consists of 49 keys covering 4 full octaves. Up to 4 notes may be played simultaneously.

TRANSPOSITION

A set of 4 TRANSPOSITION switches shift the pitch of the entire keyboard up one octave, down one octave or down two octaves from the normal pitch, effectively extending the instrument's range to 7 octaves.

PITCH CONTROLS

Two concentric PITCH controls enable the synthesizer to be continuously tuned over a 1 octave range. The outer control is for coarse adjustments and the inner knob for fine adjustments. This arrangement simplifies tuning to other instruments and enables the keyboard to be transposed to other than 1-octave intervals. A center detent facilitates rapid return to "normal" tuning.
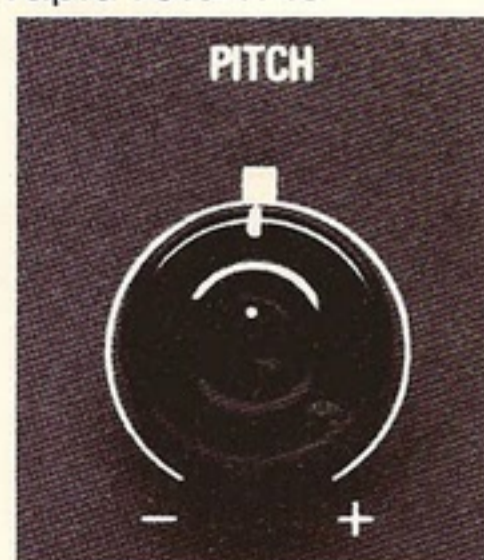
TOUCH RESPONSE

Playing the keyboard with light finger pressure will produce the notes or chords you want, but no "expression." Expressive effects can be added; the harder you press down on a key, the more effect will be added to all notes being played. The TOUCH RESPONSE controls enable you to decide whether your finger pressure will introduce vibrato (sine wave VCO sub oscillator modulation), a trill (square wave VCO sub oscillator modulation), wah-wah (sine wave VCF sub oscillator modulation with resonance), increased volume LEVEL or increased BRILLIANCE.
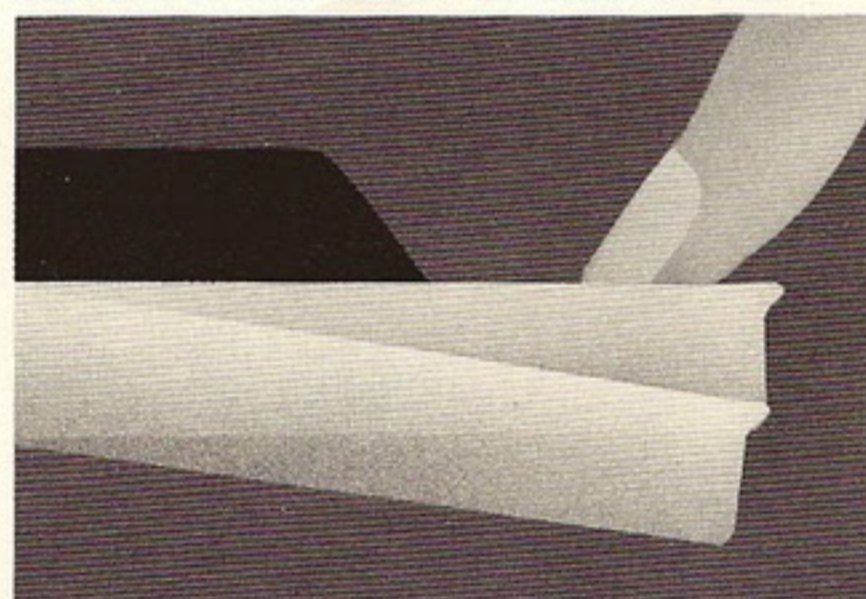
These effects can be combined, as desired. Certain of the preset patches have been pre-programmed to include touch response effects.

Preset Patches (Tone Selectors)

At the touch of a button you can select any of 13 preset patches. Actually, because you can alter the presets substantially by adjusting various of the CS-50's effects controls, you can quickly build thousands of different sounds from the basic presets. A major advantage to the preset patches is that, in a live performance, you can

avoid critical, time-consuming adjustments when moving from sound to sound. While this synthesizer is ideal for use on stage, it can save valuable time in the studio as well.

Programmable Panel

The programmable panel utilizes rocker switches and slider type controls that let you "patch" your own sounds without the inconvenience of patch cords. Build a sound by selecting and adjusting each part of it independently.

VCO (Voltage Controlled Oscillator)

The VCO produces a basic waveform for the fundamental tone: square wave, sawtooth wave, sine wave, noise, or any combination. You can change the pulse width of the square wave, add automatic pulse width modulation, and change the modulation speed simply by moving the appropriate sliders.

VCF (Voltage Controlled Filter)

The VCF filters the basic waveform, and the CS-50's VCF is unique. It consists of LOW PASS and HIGH PASS FILTERS, thus providing a variable BANDPASS FILTER. Separate RESONANCE sliders let you peak the filter response at its low and high cutoff points so that individual harmonics can be emphasized, or "wah" and "twang" effects can be introduced. Unlike many synthesizers which contain only low pass filters, the CS-50 lets you cut out any amount of the harmonics, the fundamental, or both—use any portion of the sound you want.

The CS-50 VCF has a unique set of ENVELOPE controls (IL-AL-A-D-R) that you can use to obtain automatic tonal changes. In essence, the high pass and low pass filter cutoff points move from the instant you press down a key, through the time you release the key, and during the sustain of the note (if any). The Filter's IL-AL-A-D-R
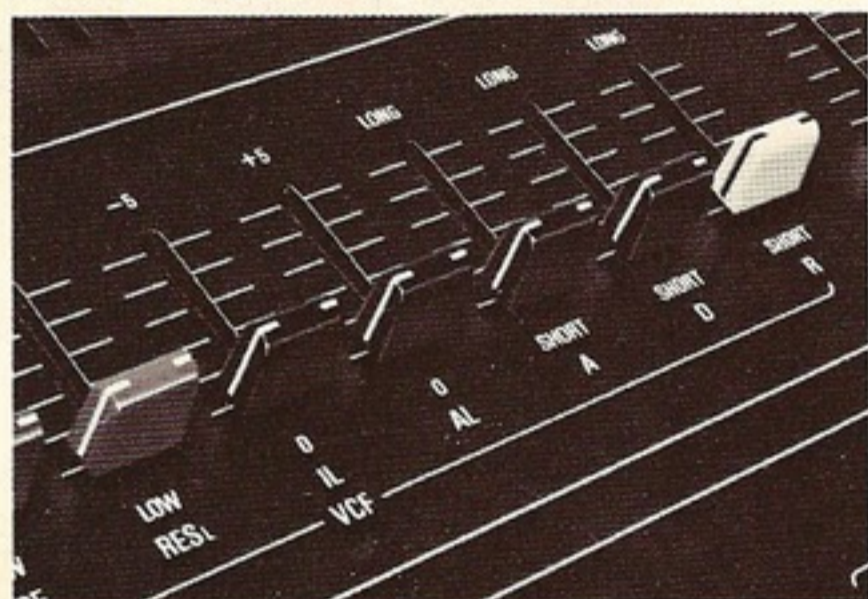
ENVELOPE is useful for simulating the changes in brilliance that characterize notes played on brass instruments, the sharp attack and mellowing decay of plucked strings, and so forth. The Filter ENVELOPE may also be used to shape notes, to turn them ON and OFF when keys are played—similar to the function of the VCA envelope.

VCA (Voltage Controlled Amplifier)

The VCA serves to define each note played—to control its amplitude when a key is first pressed down, as it is held down, and after it is released. By moving the VCA ENVELOPE controls (A-D-S-R), you can make the volume envelope appropriate for the "instrument" you are creating. You might even transform a "bass drum" into a "tuba"—the effects are up to you.

Effects Controls

The Effects Controls modify the sounds created by the Programmable Panel and by the Preset Patches. Effects are an integral part of creating any sound, and with them the CS-50's available sounds become infinite.

RING MODULATOR

RING MODULATORS can be used to create sounds like a "gong," "chimes," " bells ," etc. Technically, this is done by beating an internal sub oscillator against the input signal to obtain sum and difference frequencies. An interesting feature of the CS-50's RING MODULATOR is the envelope controls (Attack-Decay-Depth) which can be set to automatically speed up and slow down the ring modulation for "pinging," "swooping" and "android speech" effects.

SUB OSCILLATOR

The SUB OSCILLATOR may be set to generate a low frequency waveform (sine, sawtooth, inverted sawtooth, or square wave). The waveform is then used to produce regular changes in the VCO, VCF and/or VCA characteristics. For example, sine wave modulation of the VCO produces vibrato, whereas square wave modulation produces a trill. Sawtooth modulation of the VCF produces a "Jacob's
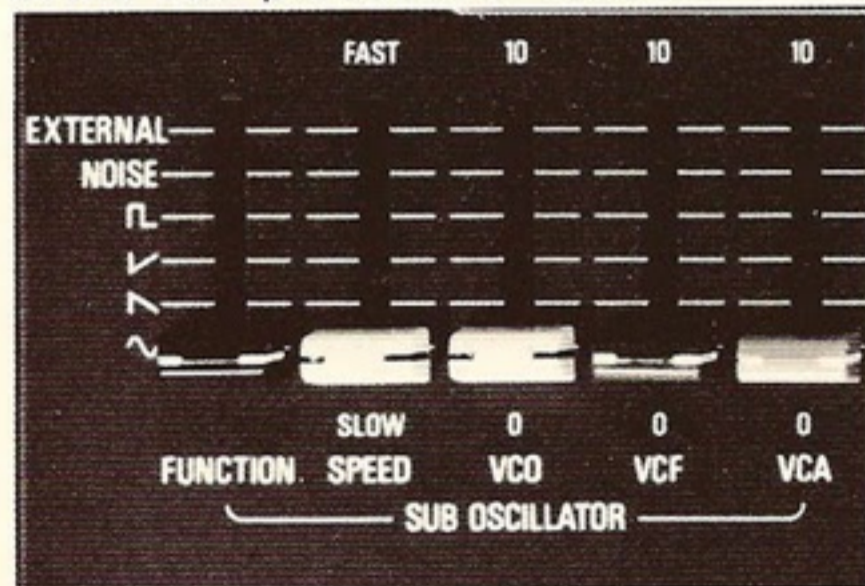
Ladder" sound, whereas sine wave modulation with resonance produces a wah-wah Sine wave modulation of the VCA creates a tremolo. The speed of the modulation is adjustable. For special effects, white noise or an external input may be used for the modulation instead of a regular waveform.

BRILLIANCE

The BRILLIANCE lever shifts the VCF low pass and high pass filter cutoff points together—moving them up for brighter sound or down for a softer sound. With a brass sound, BRILLIANCE can be used like a mute.

RESONANCE

The RESONANCE lever peaks the VCF filter cutoffs, thus stressing different harmonics (or the fundamental tone). The exact effect depends on the nature of the preset or programmed patch, and on the setting of the BRILLIANCE lever. If RESONANCE is set at maximum and BRILLIANCE is moved, expressive "wah" sounds are created.

SUSTAIN

The SUSTAIN slider determines the duration of a note—how long a note will sound after you release the key. Two types of sustain may be selected. In SUSTAIN 1 mode, each note played ends independently of any others, and all have the same sustain time (like a piano). In SUSTAIN 2 mode, the last note or chord played carries the sustain, and the next note or chord played ends any previous sustain (something like an autoharp).

PORTAMENTO & GLISSANDO

Normally, when you play two notes in succession, the change in pitch is instantaneous. PORTAMENTO causes

What you play

What you hear

Portamento

Glissando

a continuous slide in pitch from one note or chord to the next. GLISSANDO causes the pitch to move in a stepped progression; it's like playing a chromatic 1/2 step scale from one note to the next, only you don't actually play the scale. The amount of time it takes for the PORTAMENT or GLISSANDO to move from one pitch to the next is cntinuously adjustable.

Other Features

EXPRESSION PEDAL

The EXPRESSION pedal allows continuous foot control of the synthesizer's output volume. Together with the TOUCH RESPONSE controls, EXPRESSION helps you to faithfully convey very subtle musical phrasing.

REAR PANEL

The OUTPUT connector is a standard phone jack for easy interface with your sound system. To ensure compatibility, the nominal output level is switchable to 0dBm or −20dBm (into 600-ohms) and will thus drive low or high impedance inputs. An EXTERNAL INPUT jack with its own level control is

OUT PUT   HIGH LOW   FOOT CONTROLLER   IN   EXTERNAL   LEVEL

provided for access to the SUB OSCILLATOR. A jack is also provided for the EXPRESSION pedal.

HEADPHONE JACK

Any pair of 8-ohm or higher impedance stereo headphones may be plugged

PHONE

into the HEADPHONES jack below the keyboard. This is useful for monitoring and for practice when an amplifier and speaker system is not convenient.
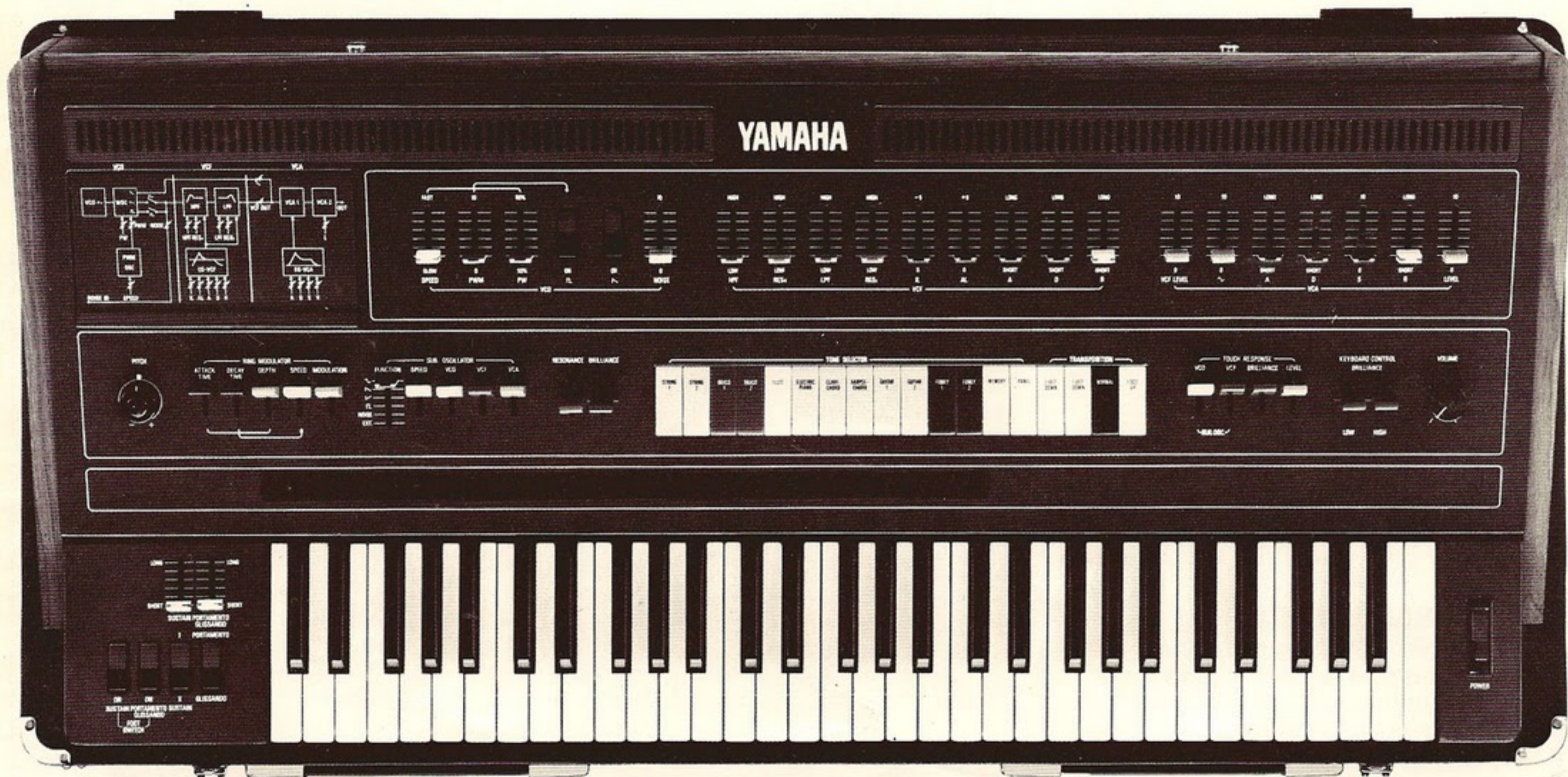
CARRYING CASE

The CS-50 is housed in a sturdy case with a removable cover that houses the detachable legs and MUSIC STAND. The case is constructed of plywood, clad in black leatherette, and has metal-reinforced corners to protect the unit while traveling. (An additional airline case is recommended for heavy cartage.) A handy vinyl carrying bag is supplied for the EXPRESSION PEDAL.

CS-60

YAMAHA

The CS-60 includes all the same features found in the CS-50,   including:

**TRANSPOSITION SWITCHES
PITCH CONTROLS
TOUCH RESPONSE
PRESET PATCHES
PROGRAMMABLE PANEL
RING MODULATOR
SUB OSCILLATOR
BRILLIANCE
RESONANCE
SUSTAIN
PORTAMENTO & GLISSANDO
EXPRESSION PEDAL
SWITCHABLE OUTPUT LEVEL
EXTERNAL SUB OSCILLATOR INPUT
HEADPHONE JACK
CARRYING CASE**

The CS-60 offers additional features as well.

The Keyboard

The CS-60 keyboard consists of 61 keys covering 5 full octaves. TRANS-POSITION switches extend the available range to 8 octaves. Also, up to 8 notes may be played simultaneously.

RIBBON CONTROLLER
A black felt strip above the keyboard lets you change the pitch of any note or chord being played. As you move a finger along the RIBBON, rock the finger, or hold it down with one finger and tap it elsewhere with a second finger, the pitch of the tone moves proportionately. You can go up an octave or down all the way to sub-audible frequencies. The RIBBON is

very useful for string bending effects —especially when combined with the EXPRESSION pedal.

KEYBOARD CONTROL

A pair of KEYBOARD CONTROL (BRILLIANCE LOW and HIGH) levers enable you to balance the brightness across the entire keyboard range. There is no abrupt change where one lever's effect ends and the other begins, although a transition occurs somewhere near the middle of the keyboard. With this feature, you can emulate acoustic instruments, which typically become brighter as they move higher in pitch. You can even make the synthesizer sound like two different instruments when you play the keyboard at top and bottom ends and use extreme KEYBOARD CONTROL settings. The effect is made possible by sophisticated digital and analog signal processing circuitry within the CS-60.
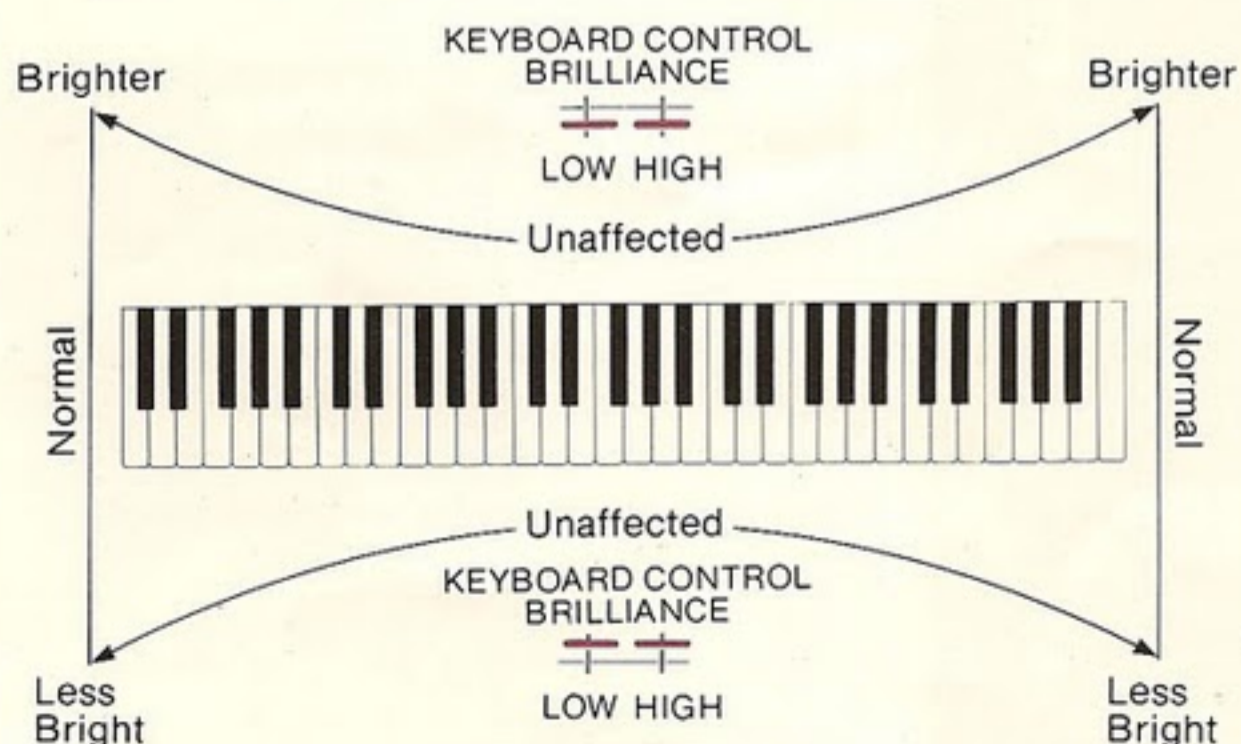
MEMORY PANEL

The CS-60 has a bank of miniature sliders and switches beneath the cover on which the block diagram is printed. These MEMORY controls correspond to the larger controls on the PROGRAMMABLE PANEL, and are set up in exactly the same way. To hear the MEMORY patch, press the Memory button in the Tone Selector section...it's like having two complete programmable panels to store your own sounds. (To make room for the Memory selector button, there is one less preset patch than on the CS-50. However, you can create the same sound as that preset by referring to the manual and setting up the MEMORY accordingly.)
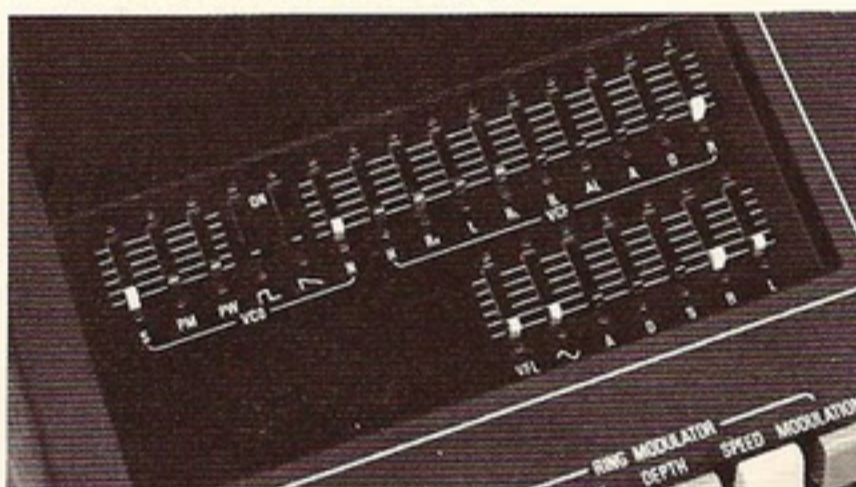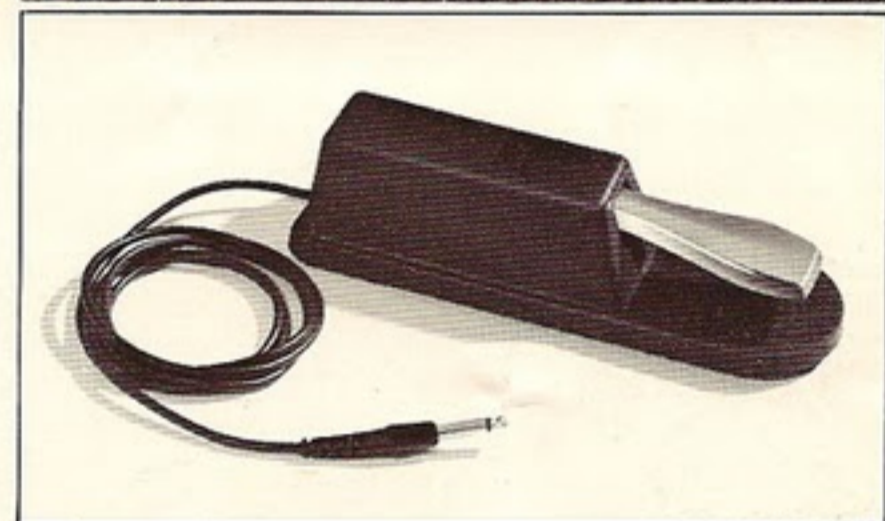

FOOT SWITCH

A FOOT SWITCH pedal allows you to turn on SUSTAIN and/or the PORTA-MENTO/GLISSANDO effect. The
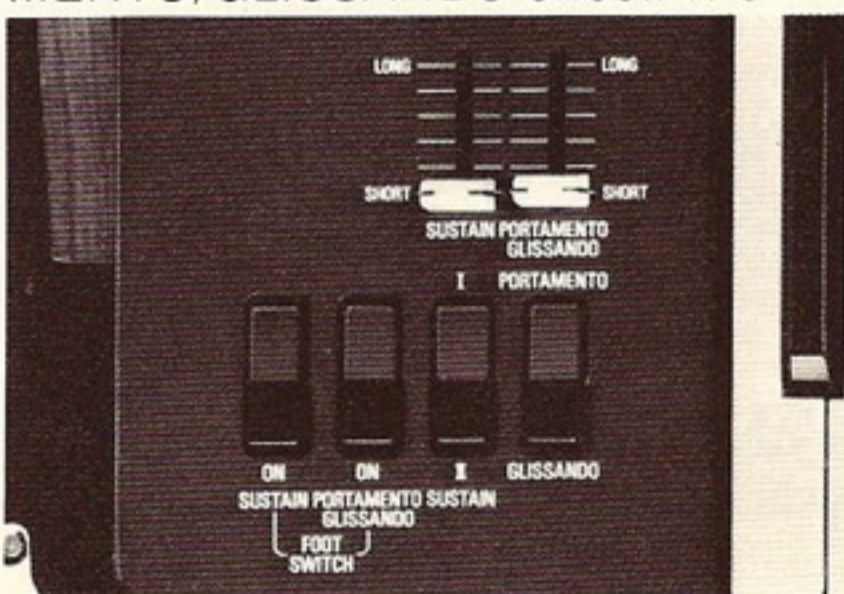
pedal plugs into the synthesizer rear panel. Switches on the front panel determine whether the SUSTAIN and P/G effects are hand or foot actuated.
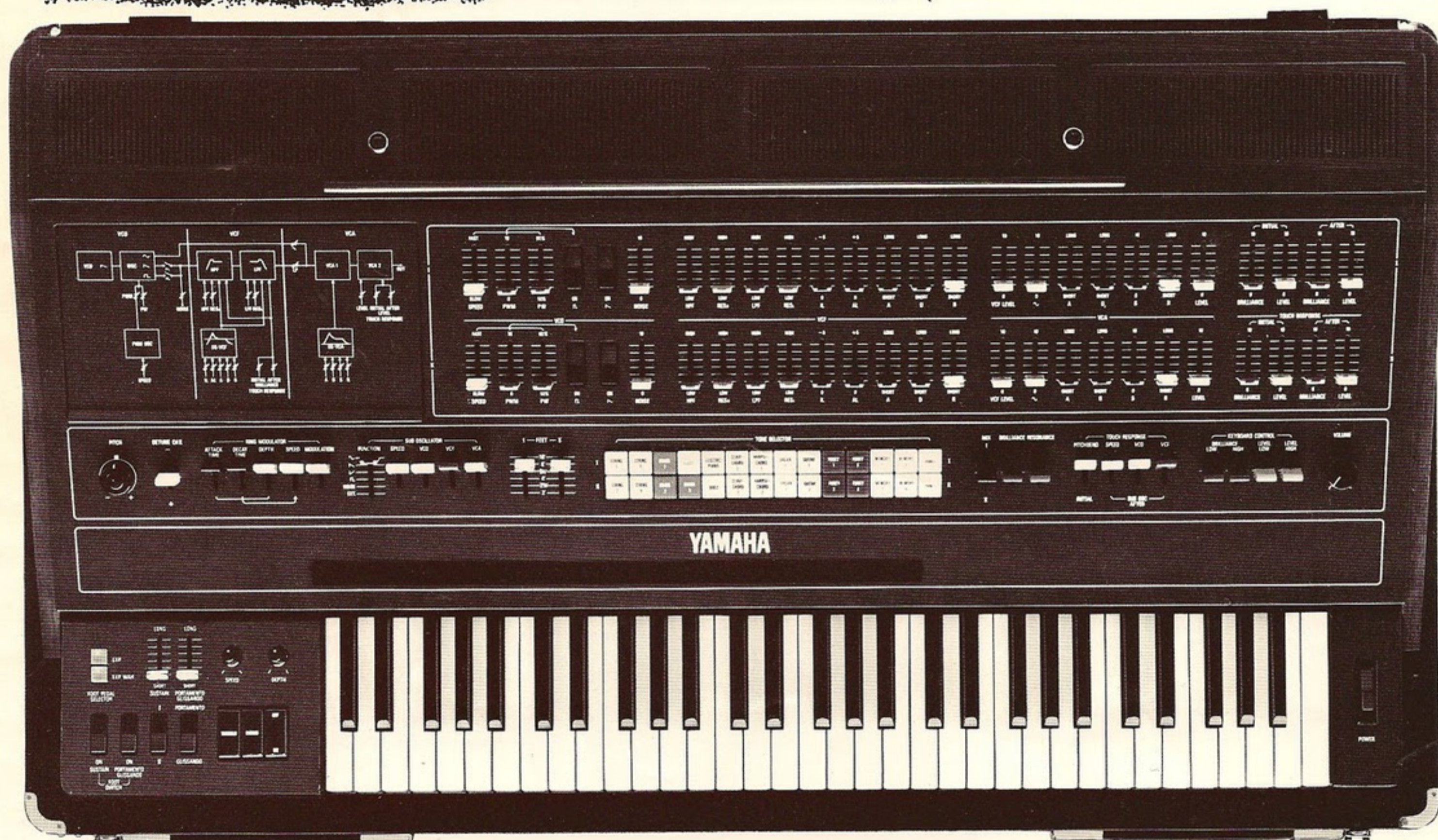

CARRYING CASE

The CS-60 is housed in a sturdy case with a removable cover that holds the MUSIC STAND. The case is constructed of plywood, clad in black leatherette, and has metal-reinforced corners to protect the unit while traveling. (An additional airline case is recommended for heavy cartage.) A separate carrying bag is supplied for the detachable leg assembly, FOOT SWITCH and EXPRESSION PEDAL.

CS-80

YAMAHA

The Keyboard

The CS-80 keyboard consists of 61 keys covering 5 full octaves. 8 notes may be played simultaneously, although because it is a 2-channel instrument, you can hear up to 16 simultaneous notes; each key played generates two voices. The action is fast, response, and feels natural because the keys have grand piano length and mass.

TRANSPOSITION is accomplished with a pair of FEET selectors that enable the pitch of the each voice to be set independently of the other.

Intermediate settings, not just octaves, are possible, and the FEET selectors extend the effective keyboard range to 8 octaves.
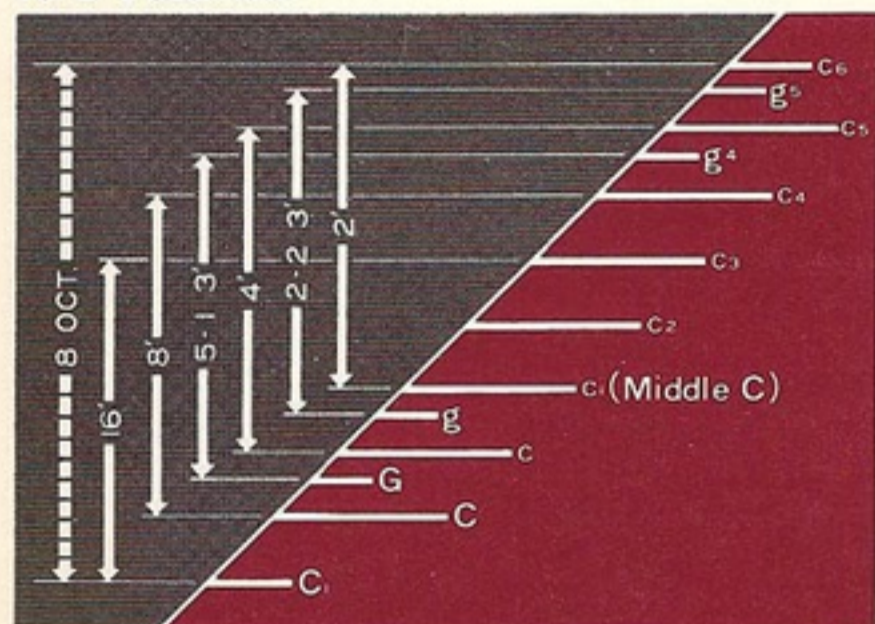

Two Channels Give You Even More Sound Possibilities

PRESET AND PROGRAMMED PATCHES

There are 22 PRESET PATCHES, 2 PROGRAMMABLE PANELS and 4 MEMORY PANELS. These 28 patches are instantly accessible via two rows (channels) of illuminated pushbuttons in the TONE SELECTOR section. Any one voice from channel I and one voice from channel II may be selected simultaneously.

MIX CONTROL

A MIX I-II lever serves as a balance control for feeding any desired proportion of channel I and channel II to the synthesizer output.
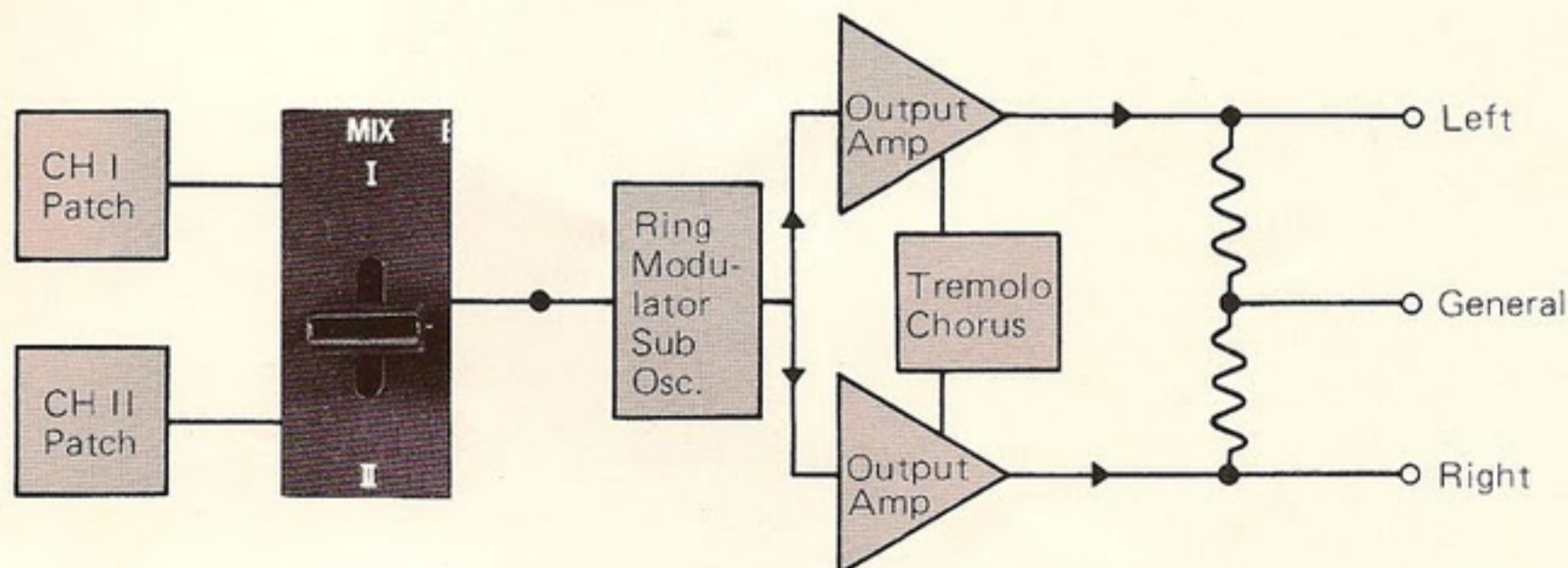
DETUNE CHANNEL II

Adjacent to the overall PITCH controls, the DETUNE CH II lever enables the pitch of the channel II to be offset from that of channel I. This is useful for creating a "honky tonk" piano, deeper string sounds, etc.

Pressure and Velocity Touch Response

TOUCH RESPONSE SECTION

The CS-80 provides *pressure-sensitive* touch response similar to that of the CS-50 and CS-60, enabling the VCO and VCF to be modulated by the SUB OSCILLATOR in proportion to how hard the keys are pressed down. In addition, the SPEED of the
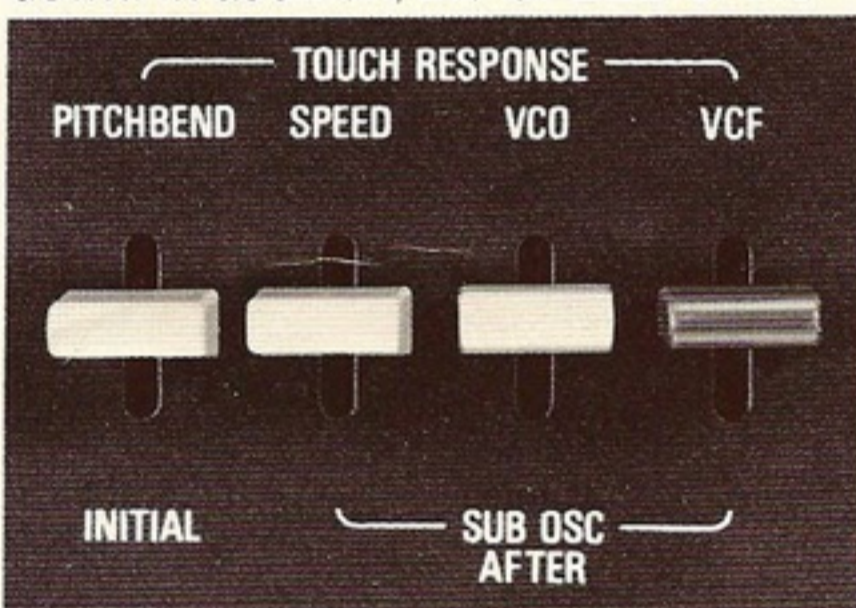
SUB OSCILLATOR can be increased by touch pressure. The CS-80 further provides for *velocity-sensitive* touch response; when the PITCHBEND lever is down, the unit produces pitchbend when a key is struck rapidly, but no pitchbend when a key is struck slowly.

PROGRAMMABLE TOUCH RESPONSE

4 additional sliders on each of the PROGRAMMABLE PANELS and MEMORY PANELS enable you to pre-program the patches with touch sensitivity. BRILLIANCE and LEVEL increases may be obtained in either of two ways. The "Initial" levers program velocity sensitivity, and the "After" levers program pressure sensitivity.
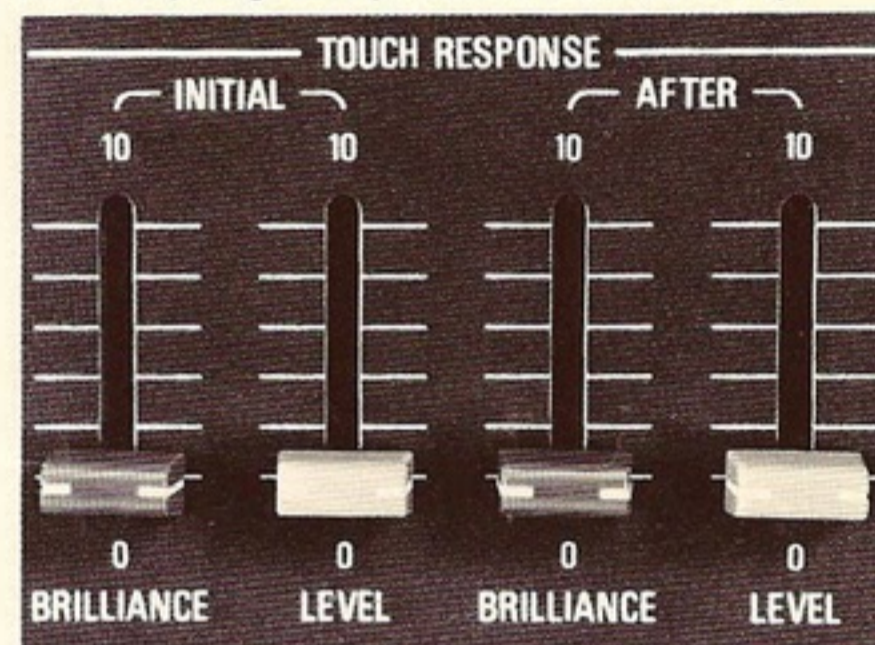
A further advance in the CS-80 are individual sensors beneath each key that provide touch response on individual notes within a chord while that chord is being played, not just on the entire chord. This is done simply by holding down all the keys and pressing harder on some than on others. (On the CS-50 and CS-60, pressing down one note will apply the touch response effect to all notes being played.) CS-80 Velocity sensitive effects are also applied to individual notes.

When you utilize the CS-80's TOUCH RESPONSE section, PROGRAM-MABLE TOUCH RESPONSE and EXPRESSION PEDAL, your musical expression is equal to or greater than that available from many acoustic instruments. It becomes possible to have a synthesizer that doesn't necessarily sound synthetic.

Other Features

EXPRESSION & EXP-WAH PEDAL

The foot controller will operate just like the EXPRESSION pedal on the CS-50 and CS-60. However, a front panel pushbutton will convert it to an EXPRESSION-WAH pedal, increasing the volume and sweeping the filters (with resonance) as the pedal is rocked back.

KEYBOARD CONTROL OF BRILLIANCE AND LEVEL

The CS-80 has the same KEYBOARD CONTROL-BRILLIANCE High and Low controls as the CS-60 for balancing the brilliance across the span of the keyboard. It also has a similar pair of LEVEL High and Low controls for balancing the volume across the keyboard range.

TREMOLO/CHORUS EFFECTS

A basic type of volume tremolo is available from the SUB OSCILLATOR by modulating the VCA with a sine wave, just as can be done on the CS-50 and CS-60. However, the CS-80 has an entirely separate circuit that produces a TREMOLO which not only moves the volume up and down, but also shifts the phase. When two separate speaker/amplifier systems are connected to the Left and Right outputs, the effect is very much like a rotary speaker. The TREMOLO Depth and Speed are adjustable, but for a very slow speed, the CHORUS switch is used. CHORUS can greatly enhance the Organ preset patches, and can produce interesting effects with Brass or other sounds.

REMOVABLE CASTERS

The CS-80 is housed in a sturdy case with a removable cover that holds the MUSIC STAND. The case is constructed of plywood, clad in black leatherette, and has metal-reinforced corners to protect the unit while traveling. (An additional airline case is recommended for heavy cartage.) A separate vinyl carrying bag is supplied for the detachable leg assembly, FOOT SWITCH and EXPRESSION PEDAL.
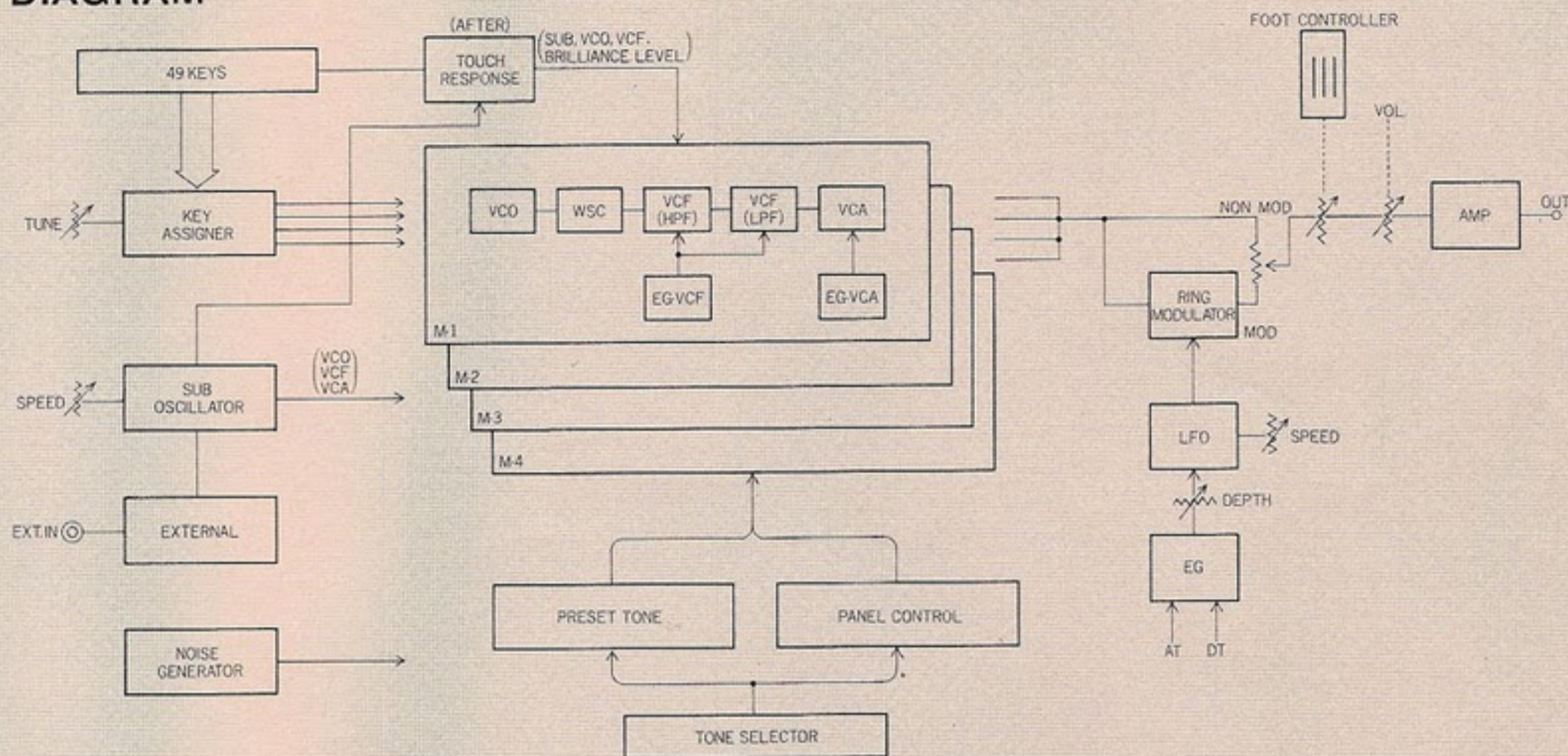
CLEAR PLEXIGLAS MUSIC STAND

The clear music stand (stored in the cover of the case) makes an elegant addition to the world's most advanced live performance synthesizer.
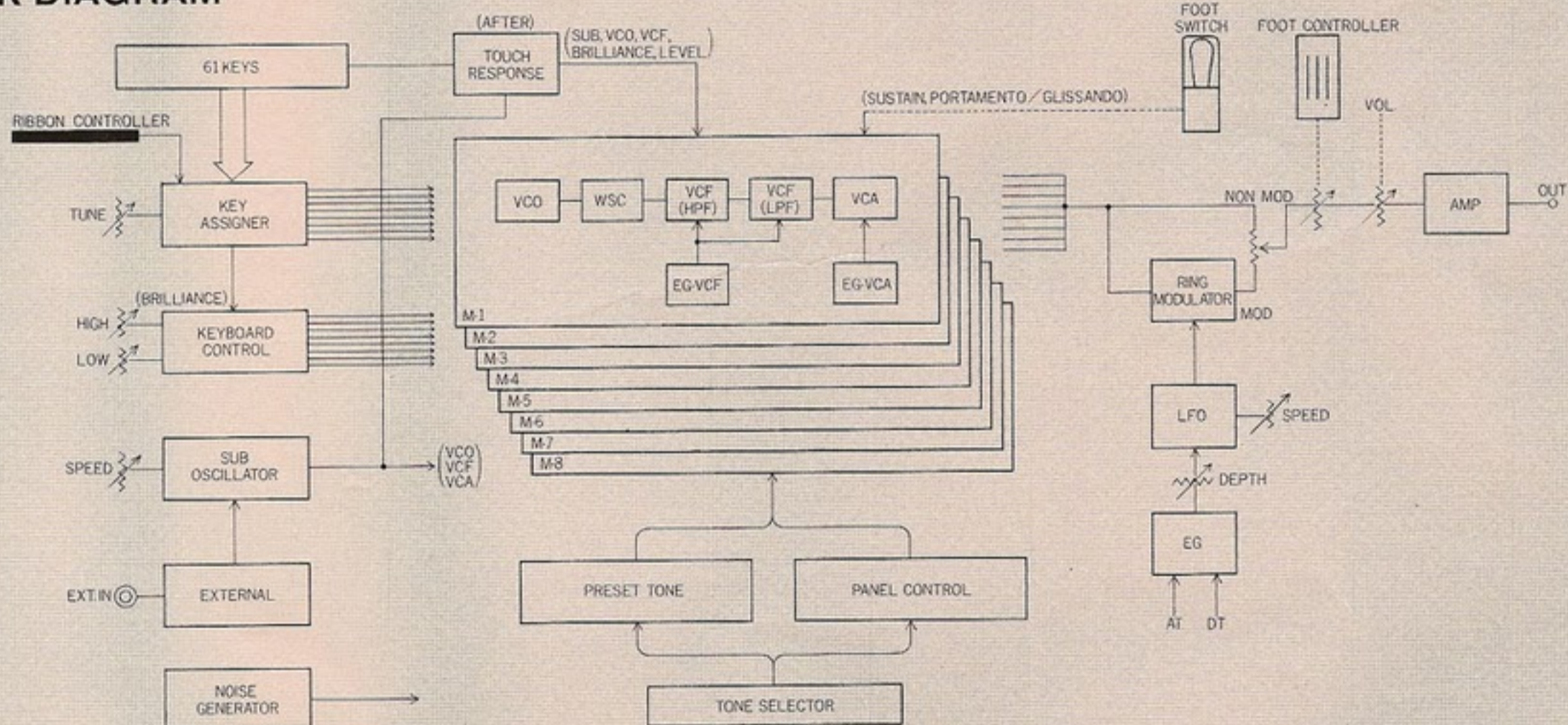
CARRYING CASE

Because the CS-80 contains more than twice the circuitry of the CS-60, it weighs more. Therefore, to make it easier to travel with the synthesizer, four removable casters are provided. They may be inserted in mating holes beneath the synthesizer in just seconds, and stored in the carrying bag when not in use.
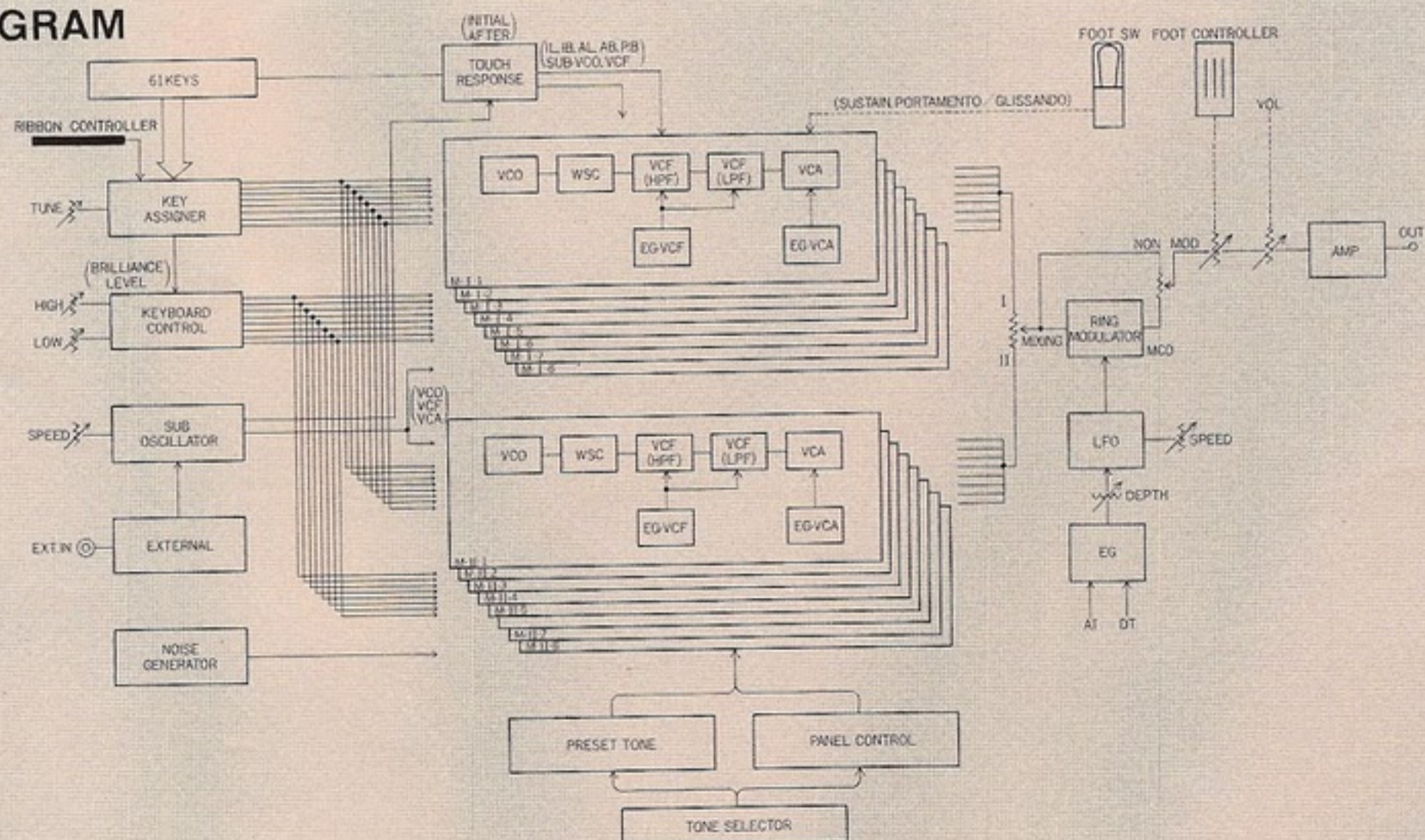
CS-50 BLOCK DIAGRAM

CS-60 BLOCK DIAGRAM

CS-80 BLOCK DIAGRAM

SPECIFICATIONS

	CS-50	CS-60	CS-80
Keyboard	49 keys, c through c₄ (4 octaves).	61 keys, C through c₄ (5 octaves).	
Transposition	Four pushbuttons: normal, 1 octave below normal, 2 octaves below normal, and 1 octave above normal.		One FEET selector per channel: 1 octave below normal to 2 octaves above (6 settings each).
Available Fundamental Frequency Range	32Hz~4kHz.	16Hz~4kHz.	32Hz~8kHz.
Pitch Tuning Range	COARSE TUNE: approximately 1 octave (−500 cents to +700 cents).		
	FINE TUNE: approximately +14, −11 cents.	FINE TUNE: approximately ±30 cents.	
Simultaneous Notes	Up to 4 notes.	Up to 8 notes.	
Total Number of Voices	13 preset patches & 1 programmable panel.	12 preset patches, 1 memory & 1 programmable panel.	22 presets, 2 programmable & 4 memory panels arranged so 2 voices may be sounded at once.
External Input Characteristics	Unbalanced, standard ¼" phone jack, 50k-ohm actual impedance (for low or high impedance sources). Nominal sensitivity 10 millivolts rms (30 millivolts peak-to-peak) with EXT IN level at maximum.		
Output Characteristics	HIGH range, 0dBm (0.775 volts rms) or LOW range, −20dBm (77.5 millivolts rms); nominal output when playing four notes, all volume or level controls at maximum. Unbalanced, standard ¼" phone jacks. Actual 600-ohm output source impedance (for low-Z or high-Z loads).		
Headphone Output	250 millivolts rms nominal. Unbalanced, Tip/Ring/Sleeve ¼" phone jack for stereo headphones (8-ohm or higher impedance).		
Circuitry	All solid state; keyboard and note assigning circuitry is digital; all audio circuitry is analog, with voltage controlled oscillators, amplifiers, filters, and envelope generators.		
AC Power	Nominal 115V AC, 50 or 60Hz. Grounded (3-prong) power cord stores in covered compartment beneath synthesizer.		
	55 watts maximum.	85 watts maximum.	180 watts maximum.
Finish	Black leatherette with metal-reinforced corners; walnut-grained vinyl side panels.		Black leatherette with metal-reinforced corners; walnut veneer side panels.
Dimensions — In Case:	38½"(W)×9⅞"(H)×20⅛"(D) (98.1×25.2×51.1 cm).	43⅝"(W)×10⅜"(H)×21⅝"(D) (110.9×26.4×55.0 cm).	47½"(W)×12"(H)×27⅝"(D) (20.5×30.4×70.2 cm).
Dimensions — Assembled:	38⅝"(W)×36⅝"(H)×20⅛"(D) (98.1×93.0×51.1 cm); Keyboard height, 33⅛" (84.2 cm).	43⅝"(W)×37⅛"(H)×21⅝"(D) (110.9×94.2×55.0 cm); Keyboard height, 33⅛" (84.2 cm).	47½"(W)×38"(H)×27⅝"(D) (120.5×96.5×70.2 cm); Keyboard height 33⅛" (84.2 cm).
Weight (including all standard accessories)	79.4 pounds (36 kg).	101.4 pounds (46 kg).	220.5 pounds (100 kg).
Standard Accessories	Detachable hard cover. Music rest (stores in cover). Foot Controller (expression or expression/wah pedal). Foot Switch Pedal (CS-60 & CS-80 only). Tube of Yamaha Key Cleaner Creme. Instruction Manual. Vinyl case for Foot Controller (CS-50 only). Vinyl carrying bag for legs & accessories (CS-60 & CS-80 only). Detachable Casters (CS-80 only).		

Specifications subject to change without notice.

For details please contact:

SINCE 1887 ⊛ **YAMAHA**

International Corp., Box 6600, Buena Park, Calif. 90620.