

vco		PERFORMANCE	PRESET	SYSTEM	CS-80 PROGRAMMER STORE		FAS
		CS-80 ESCAPE	ENTER			SE	Π
РІТСН	DETUNE CHI	ATTACK DECAY TIME TIME	NG MODULATOR DEPTH	SPEED MODUL	ATION FUNCTI	ON SPEED	SCILLATOR - VCO

USER MANUAL v1.0

INTRODUCTION

When you are reading this, you are probably the proud owner of one of the most famous (and heaviest) synthesizers in the world: The Yamaha CS-80, a true legend. And that's not the only thing, you probably also have installed the Cox Electronics upgrade.

Here is a short summary of features provided by the upgrade:

- 3 banks of 128 free programmable performances
- 6 banks of 128 free programmable presets
- possibility of dumping performances and presets by SysEx
- MIDI sending and receiving of almost every parameter
- autotuning possibility of all 16 oscillators
- 3 extra separate global LFOs for VCO, VCF and VCA
- special playmodes providing voice stealing, mono and unison with detune
- VCF and VCA envelope time can seperately be switched to 5 times the length
- all electrolytic capacitors have been replaced since the old ones are bad
- all sliders are professionally cleaned
- cleaning and readjustment of keyboard contacts
- cleaning of polyphonic aftertouch parts
- complete calibration of all circuit boards
- the very rare YM26600 and YM26700 chips are replaced by modern electronics

Almost every parameter of the synthesizer can be stored in memory and can receive and send MIDI data. For only a few knobs/sliders this is not possible, so it's easier to mention those:

- detune CHII slider
- the four touch response sliders
- the master volume knob (exp can be controlled by footcontroller and MIDI)
- foot pedal exp/expwah switches
- sustain slider (although it can be controlled on/off by footswitch and MIDI)
- the switches and knobs of the tremolo and chorus section

In this manual the CS-80 synthesizer itself will not be explained, just the features of the controller box and the upgrade. So it is assumed you are familiar with the Yamaha CS-80 synthesizer. Let's start.

PERFORMANCE MENU

When you power up the CS-80 and the controller box is connected, it will start searching for the synthesizer. Also the CS-80 will start searching for the box. Once they have found each other you can start working with it. If the CS-80 synthesizer wasn't able to find the controller box, it'll work like no upgrade was installed after about 10 seconds.

Initially PANEL I and II will automatically be selected and the last selected performance will be loaded in memory. A performance contains the settings of the common parameters for channel I and II like ringmodulator, LFO, feet, volume, brilliance, resonance, playmode and keyboard settings. It also contains directions to the presets used for channel I and II. Presets are the collection of all slider and switch settings of panel I or II. On the controller box you'll find a switch called performance and a switch called preset. Pressing those switches you'll get direct to those parameters. With the dial you can move through all the menus. The LED of each switch will let you know if you are in the performance, preset or system menu. The parameters of each menu will be shortly explained in the next chapters.

Init.Performance A001

This is the first menu to appear after you power up the synthesizer. It displays the name of the selected performance and the location in memory. In this case the performance is called Init.Performance and is located at position 001 of bank A. By pressing [ENTER] a cursor will appear and you can change the bank number. There a 3 banks (A-C) of 128 performances. By pressing [ENTER] again you can change the performance number. If you wait about 4 seconds the current selected performance and it's corresponding presets will be automatically loaded. At this point it's not finally loaded in memory but just temporarily for audition therefore they can not be edited yet by moving the sliders on the panel. You can move through them and listen to the different sounds. If you press [ESCAPE] you'll get back to where you started from, by pressing [ENTER] the performance will be loaded in memory and you'll move to that location. If you press [ESCAPE] when you are not selecting a performance, the following will appear in the display:

With the dial you can move between ALL, PANEL I, PANEL II or PERFORMANCE. When pressing [ENTER] all the current slider and switch settings of the selected option will be loaded in memory. By pressing [ESCAPE] again you'll get back without anything to happen.

Turning the dial one position to the right will get you to the next menu, where the directions to the presets can be changed.

```
A001 Init.Preset
B001 Init.Preset
```

This means preset A001 is loaded for PANEL I and preset B001 is loaded for PANEL II. Again by pressing enter you can change the bank number. This time there are 6 banks available called A to F. Initially for all performances in bank A, the PANEL I presets are mapped to bank A and the PANEL II presets to bank B. For the performances in bank B, PANEL I presets to bank C and PANEL II presets to bank D. For performances in bank C, to E and F. This is how it's initially done but you can change them to where you like. By pressing [ENTER] without using the dial you can get to the PANEL II preset location without loading anything in memory. The current settings of all sliders and switches for PANEL I will be kept in memory. By pressing [ESCAPE] you can see the original preset locations of the selected performance. For example: if you changed the presets here and you want to get back to the original settings without reloading the performance, just press [ESCAPE] and the original values will be displayed. This also works for most of the other settings like all slider settings. When walking through the presets after about one second the preset will be automatically loaded temporarily in memory so you can hear how it sounds. If you like it then press [ENTER], if not select another one. When selecting presets it's not possible to use the sliders for PANEL I and II. But you can still use the performance sliders and switches. For example to try different feet settings for a preset. Let's move to the next menu:

CH1	feet:	8'
CH2	feet:	8'

Here the feet settings of channel I and II are displayed. Again by pressing [ENTER] you can change the setting, [ESCAPE] can be used to get out without changing. Also the original value of the performance can be displayed here by pressing [ESCAPE].

The next menu shows the mix slider setting. This is the balance in volume between the presets for channel I and II. Changing these settings happens the same way as in the previous menus. From now on that's not explained anymore since this works the same everywhere. The unison detune setting is new for the CS-80. This setting can be used in the several unison modes to spread the pitch of the voices for a very big sound if desired. But it is also used in poly modes to create a vintage detune between the several voices. If your CS-80 seems out of tune in a poly mode even after autotune, check if unison detune setting is set to 000.



Here it is possible to change the playmode. There are several playmodes available:

poly (polyphonic): This is about the same as the original behavior of the CS-80 to allocate voices. But it is a bit improved since the voice allocation routine checks which voice has been used the longest time ago and then uses that voice. In that way the maximum release time for all the different voices will be audible.

poly+vs (polyphonic + voice stealing): the same as above with the addition that if all 8 voices are in use and a new key is pressed, a voice will be reused for that key. Again the allocation routine checks which voice has been used the longest time ago and then uses that voice.

mono (monophonic): only one voice will be used like a monophonic synthesizer.

mono2vu (monophonic 2 voices unison): like above but now with 2 voices. This is a unison playmode so the unison detune parameter in the previous menu can be used here.

mono4vu (monophonic 4 voices unison): like above but now with 4 voices.

mono8vu (monophonic 8 voices unison): like above but now with 8 voices.

poly2vu (polyphonic 2 voices unison): this is a polyphonic playmode, but now with 2 voices in unison.

duo4vu (duophonic 4 voices unison): this is a duophonic playmode, 2 keys can be pressed but with 4 voices in unison.

The retrigger option is only available for the monophonic playmodes. If set to off then if you press a key and you press another key without depressing the previous key. The pitch of the new key will be selected but the envelopes for VCF and VCA won't be retriggered. If set to on, the envelopes will be retriggered. Try this with a long release setting of the VCA envelope and you'll notice the difference.

Next we'll get to the extra LFOs. There are 3 separate extra LFOs available for VCO, VCF and VCA. They are all the same so only the options for the VCO LFO will be explained.

[VCO LFO] function: tria9]

The waveforms that affect the pitch of the LFO can be selected here. Available is: triagl (triangle), saw dn (saw down), saw up, square, random, envlop (envelope). The last one is special, it's actually the curve of the fade envelope. It's a kind of an attack or decay envelope dependent of the setting of the fade time. With this you can do very long and deep attack times on for example the VCF, although a kind of paraphonic, it can be quite useful.

The fade time setting is the amount of time for the LFO waveform to fade in or out. At +00 there is no fade in or out, positive settings allow the LFO waveform to fade in, negative settings to fade out.

[VCO LFO] depth: 000

This is the amount the LFO waveform affects the pitch of the VCO at maximum level.

The frequency of the LFO waveform is set here. At 000 there is no frequency, the LFO is stopped. This can be used in combination with sync and sync degree for useful effects.

This determines how the LFO is synced. It's possible to restart the LFO waveform in different ways. Setting can be: off, keyboard, MIDI clock or keyboard + MIDI clock.

This is the point where the LFO waveform is restarted by the sync setting. It can be 0, 90, 180 or 270 degree.



The MIDI clock division factor can be set here. At 000 there is no division, so the LFO will not restart by the MIDI clock. Only the real LFOs will be restarted bij the MIDI clock and/or keyboard, not the special envelope option that can be selected.

For VCF and VCA there is a different LFO, but the functions are the same as the one for the VCO, so they will not be explained here.

```
[RING MODULATOR]
attack time: 000
```

Here are values of the sliders of the ring modulator stored. Attack time, decay time, depth, speed and modulation.

```
[SUB OSCILLATOR]
function: sine
```

All settings of the CS-80 sub oscillator (LFO) are stored here. Function, speed, VCO depth, VCF depth and VCA depth.

```
brilliance: +00
resonance: 000
```

Represents the green brilliance and red resonance slider.

The four settings of the keyboard sliders are stored here.

portam.time:	000
portam.mode:	ana

Portamento/glissando time is stored here. Analog or digital portamento mode can be selected. Analog is the original CS-80 mode, the time to glide from note to note depends on how far the notes are away from each other. In digital portamento mode this time is always the same.

The ribbon controller depth represents the amount the ribbon controller affects the pitch of the VCOs. At low settings there will be a minimal influence of the ribbon controller to the pitch. When moving the finger over the ribbon controller, the last value can be hold by the footswitch if the footswitch hold setting is on and you remove your finger.

Here something special is happening again. The settings of this are also stored in the performance. If you press [ENTER] you'll see the following:



Four different MIDI controllers can be linked to the footcontroller simultaniously. The MIDI controller number can be selected at CC. Initially it's 007 for channel volume, but this can be set to any controller from 1 to 127. At min and max the values can be set where the footcontroller moves in between. These values can also be reversed if you set min to 127 and max to 0 for example.

PRESET MENU

Those were all parameters stored in a performance, now we'll go to the presets. The values represent all the settings of the sliders and switches in PANEL I or II. If you press the [PRESET] button you'll toggle between the PANEL I or II settings of a parameter. Also [ESCAPE] can be pressed to see the original setting of a preset. When [ENTER] is pressed you can change this setting. Not every parameter will be explained here since it's very easy. They represent the sliders and switches of PANEL I and II. But 2 more settings are added, VCF env time X5 and VCA env time X5. Originally the attack times of the CS-80 are quite short. Now it's possible to make them much longer, very useful for slow pads.

STORE PERFORMANCE / PRESET

It is possible to store performances and presets. When you are in the performance menu and you press the [STORE] button it is possible to store a performance. If you are in the preset menu and press the [STORE] button then you can store a preset. You'll be asked if you want to change the name. [ESCAPE] is no and [ENTER] is yes. When changing the name you can move the cursor to the left and right with the [ESCAPE] and [ENTER] button. With the dial you can change characters. The [PERFORMANCE] button will get you quickly to the "A" character. The [PRESET] button will get you quickly to the "a" character. When you press the [SYSTEM] button a space will appear. If you have changed the name then press [STORE] again, next you can select in which bank and number to store it. Finally you'll be asked if you are sure. Press [STORE] again here if you want to store it, you can cancel by pressing [ESCAPE]. If you are storing a performance then you'll also be asked if you want to do that because the panel sliders have probably been changed.

SYSTEM MENU

autotune press [ENTER]

In the system menu a lot of nice features are available. If you enter the autotune menu you can start the autotune routine. All 16 VCOs will be tuned equally in pitch at middle A. They are always tuned in the current feet setting that is selected. For example if you autotune in 8' then these settings are stored. If you switch to 4' you'll have to autotune again for that feet setting, but if you move back to 8' then they will be back in tune again according to the last time you pressed autotune there.

If it's not possible to autotune a VCO then that voice will be automatically disabled. This will happen for both channels I and II. In the disable autotune menu it's possible to cancel this again. All voices will be enabled and all autotune values will be back to initial, just like when you powered up the CS-80 synthesizer.

In the disable voice menu you can disable a voice. If something is wrong with one of the voices and the autotune routine doesn't notice this then you can disable that voice here. Only in poly, poly+vs and mono playmodes these voices will be disabled. In all unison modes they will be enabled again and you can hear them.

voice: 12345678 *

There is an easy way to see which voice is bad if you enter the check voices menu. An asterisk will appear below the voice number when you press keys.

chord memory press [ENTER]

If you press [ENTER] here you'll activate the chord memory. Eight different keys can be pressed to represent a chord. The first key you press is the base note. If no key is pressed but [ENTER] is pressed again, you'll deactivate chord memory. Chord memory settings are not stored if you switch the CS-80 synthesizer off.

Not much to explain here. The MIDI send and receive channel can be set here and the local on or off setting. If local is off, playing the keyboard, moving sliders and pressing switches is not directly sent to the synthesizer but only to the MIDI-OUT port. This is mostly used when the synthesizer is connected to a recording sequencer.

The CS-80 keyboard send and receive MIDI data for note on and off can be shifted here from -3 to +3 octaves. This can be very useful if you are using the CS-80 as a master keyboard. Tracking is the possibility of automatically getting to the corresponding menu if a slider or switch is moved.

initial: norm aftertouch: norm

These parameters represent the intensity of the CS-80 keyboard to respond to initial (= velocity) and aftertouch. For initial also a solid value can be set from 8 to 127. If you set it for example to 127 then the keyboard velocity value send by MIDI will always be the maximum value.

aftt.mode: poly autosend: off

Here you can set if the keyboard of the CS-80 should send polyphonic or monophonic aftertouch data by MIDI. If you activate autosend then each time you change a performance or preset all parameter values of the sliders and switches of that performance or preset are send by MIDI continues controller values. This will also happen if you send a program change command by MIDI to the CS-80.

pbend lvl: 1note mastertune: +00

The maximum response to pitchbend commands by MIDI is set here. One note, 5 notes or one octave is available. Below the mastertune of the CS-80 can be adjusted from about -50 to + 50 cents. This replaces the pitch potentiometer on the panel for better stability.

```
enc.limited: off
dtrg.rmtime: off
```

By selecting encoder limited to on, it won't be possible to dial round and round. It will stop at 0 or 127 when changing parameter settings. The other option is called the double trigger remover. When playing the CS-80 keyboard, the keys can sometimes be a bit "jumpy", which might cause double triggering of notes. You can switch this option to off or a remove time can be set, it's the time between a new triggering of the same note is not allowed to happen.

```
data dump
press [ENTER]
```

Here you can enter the data dump menu. You'll be asked what to dump, current, performance or preset. If you choose for the current dump option, then the data of the current selected performance plus the associated presets will be dumped. If played back to the CS-80 it will not overwrite any memory data but become active as the current performance. That way you can store a sound inside a sequence. You can also do a current performance request by sending a SysEx string to the CS-80: F0, 3F, 00, 00, 06, F7

If you choose for performance or preset, you decide if you want to dump a complete bank or a single performance or preset. If you choose bank then you can select which one. For performance from A to C and for preset from A to F. The SysEx MIDI stream will be send containing all the data.

If you play the recorded stream back to the CS-80, the single data will be put in the current selected performance or PANEL I preset, but it is not stored in memory yet. If you send a complete bank to the CS-80 then you'll be asked in which bank to store the data after it is received.

```
remap presets
press [ENTER]
```

In this menu it is possible to remap preset locations in performances. If for example you loaded a SysEx bank of performances which was previously in bank A and the preset locations for PANEL I are mapped to preset bank A. But now you loaded them in bank B, the preset locations are still mapped to bank A. If you loaded the presets to for example bank C then you need to change this. You can remap this, first select the desired performance bank, then if it's for PANEL I or II. Then you can select the range of presets to remap from 1 to 128. Next you can select the preset bank (A-F) where to remap them to. Of course remapping can also be necessary if you copied presets to a different bank.

```
сору performance
press [ENTER]
```

In this menu you can copy the data of performances. First select the source bank and the range of numbers. Then the destination where to put them, bank and start number.

COPY Presets Press [ENTER]

The same as above but now for the data of the presets.

This is the last menu, it simply shows which software version the controller box is running.

Some short notes on some control change messages: 102 and 103 are the ribbon controller LSB and MSB. Its values will only be active after setting 103. So always first set 102 and then 103. It is also possible to just use 103 for less accurate pitch changes. 0 is used for bank select, the bank will be entered after using a MIDI program change command.

Finally I'd like to thank Phillipe B. for having very big confidence in me taking apart his Yamaha CS-80 synthesizer for this project. He also had a lot of patience since he needed to wait quite a while before this all was finished.

Have fun and best regards,

Mark Cox Cox Electronics, 2021

MIDI	control	change	messages	impl	Lementation	list
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CC	parameter	value
0	bank select	0-2
1	modulation wheel*	0-127
5	portamento time	0-127
7	channel volume	0-127
8	CH1 feet setting	0-5
9	CH2 feet setting	0-5
10	PNL1 PWM speed	0-127
11	PNL1 PWM depth	0-127
12	PNL1 PW	0-127
13	PNL1 pulse	0-63 = off, 64-127 = on
14	PNL1 saw	0-63 = off, 64-127 = on
15	PNL1 noise level	0-127
16	PNL1 HPF frequency	0-127
17	PNL1 HPF resH	0-127
18	PNL1 LPF frequency	0-127
19	PNL1 LPF resL	0-127
20	PNL1 VCF IL	0-127
21	PNL1 VCF AL	0-127
22	PNL1 VCF attack time	0-127
23	PNL1 VCF decay time	0-127
24	PNL1 VCF release time	0-127
25	PNL1 VCF level	0-127
26	PNL1 sine level	0-127
27	PNL1 VCA attack time	0-127
28	PNL1 VCA decay time	0-127
29	PNL1 VCA sustain level	0-127
30	PNL1 VCA release time	0-127
31	PNL1 VCA level	0-127
32	PNL1 initial brilliance	0-127
33	PNL1 initial level	0-127
34	PNL1 aftertouch brilliance	0-127
35	PNL1 aftertouch level	0-127
36	PNL2 PWM speed	0-127
37	PNL2 PWM depth	0-127
38	PNL2 PW	0-127
39	PNL2 pulse	0-63 = 0ff, 64-127 = 0n
40	PNL2 saw	0-63 = 011, 64-127 = 00
41	PNL2 noise level	0-127
42	PNL2 HPF Irequency	
43	PNL2 HPF TeSH	0 127
44	PNL2 LPF TIEquency	0-127
10	DNL2 VCF II.	0 127
40	PNI,2 VCF AL	0 127
48	PNL2 VCF attack time	0-127
49	PNL2 VCF decay time	0-127
50	PNL2 VCF release time	0-127
51	PNL2 VCF level	0-127
52	PNL2 sine level	0-127
53	PNL2 VCA attack time	0-127
54	PNL2 VCA decay time	0-127
55	PNL2 VCA sustain level	0-127
56	PNL2 VCA release time	0-127
57	PNL2 VCA level	0-127
58	PNL2 initial brilliance	0-127
59	PNL2 initial level	0-127
60	PNL2 aftertouch brilliance	0-127
61	PNL2 aftertouch level	0-127

* CS-80 responds like receiving mono aftertouch

MIDI	control	change	messages	imp	lementation	list
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CC	parameter	value
62	unison detune	0-127
63	portamento/glissando	0-63 = porta, 64-127 = gliss.
64	sustain off/on*	0-63 = off, 64-127 = on
65	portamento off/on*	0-63 = off, 64-127 = on
66	ribboncontroller hold off/on*	0-63 = off, 64-127 = on
67	KEYBOARD: brilliance low	0-127
68	KEYBOARD: brilliance high	0-127
69	KEYBOARD: Level low	0-127
70	KEYBOARD: level high	0-127
70	reserves	0_127
71		
72	CHI+Z MIX	
/3	sustain mode	0-63 = 1, 64-127 = 11
/4	brilliance	0-127
75	VCO LFO: function	0-5
76	VCO LFO: fade time	0-127
77	VCO LFO: depth	0-127
78	VCO LFO: speed	0-127
79	VCF LFO: function	0-5
80	VCF LFO: fade time	0-127
81	VCF LFO: depth	0-127
82	VCF LFO: speed	0-127
83	VCA LFO: function	0-5
84	VCA LFO: fade time	0-127
8.5	VCA LFO: depth	0-127
86	VCA LFO: speed	0-127
87	RINGMODULATOR: attack time	0-127
88	RINCMODULATOR: docay time	0_127
00	RINGMODULATOR: decay cime	0_127
0.9	RINGMODULATOR. depth	
90	RINGMODULAIOR: Speed	
91	RINGMODUALIUR: MODULALIUN	
92	SUB OSCILLATOR: function	0-5
93	SUB OSCILLATOR: speed	0-127
94	SUB OSCILLATOR: VCO depth	0-127
95	SUB OSCILLATOR: VCF depth	0-127
96	SUB OSCILLATOR: VCA depth	0-127
97	playmode retrigger	0-63 = off, 64-127 = on
98	PNL1 VCF env time X5	0-63 = off, 64-127 = on
99	PNL1 VCA env time X5	0-63 = off, 64-127 = on
100	PNL2 VCF env time X5	0-63 = off, 64-127 = on
101	PNL2 VCA env time X5	0-63 = off, 64-127 = on
102	ribbon controller byte1 (LSB)	0-127
103	ribbon controller byte2 (MSB)	0-127
104	ribbon controller depth	0-127
105	VCO LEO MIDI clock div factor	0-127
106	VCE LEO MIDI clock div factor	0-127
107	VCA LEO MIDI clock div factor	0_127
100	VCA LFO MIDI CIOCK UIV.IACCOI	
100	VCO LEO: Sync mode	
110	VCF LFU: Sync mode	
110	VCA LFU: sync mode	
111	VCO LFO: sync start degree	
112	VCF LFO: sync start degree	0-3
113	VCA LFO: sync start degree	0-3
122	portamento mode setting	0-63 = ana, 64-127 = dig
123	all notes off	don't care
		l

* footswitch selector switches should be set