



# S80 Music Synthesizer Power User: Working with and Understanding Physical Controllers

## Potential Questions Answered in this document:

- I can't get controller "x" to fully control parameter "y" in an S80 sound.
- I can't get the Foot controller or MW to control the value of the parameter I assigned.
- The assignable Knobs 1 / 2 only work from 12 o'clock to 5 o'clock – there is no change from 7 to 12 o'clock.
- I set the depth to maximum range +63 and I still get no change in the assigned parameter.

## How to use this document:

This article uses internal S80 AWM2 sampled based VOICES for the examples. The edit screens and parameters available for the sample playback Voices (PRE1, PRE2, INT, EXT) and the screens and parameters available for the various PLG plug-in board technologies will differ according to the plug-in technology in question (see separate guides on the PLG Series). This is a tutorial and assumes you are making the button pushes as it advances. By following the example setup, you will gain an insight into how the controllers work and how they can be assigned to your advantage. All possibilities could never be covered in a short guide but this should get you on your way.

After going through this article feel free to experiment with other assignments.

## Assigning S80 Controllers in Voice Mode

Within the architecture of each AWM2 (sampled-based) Voice is a set of 6 controller assignment setups. You can program how the physical controllers (MW, PB, AT, KN 1, KN 2, FS, and BC) will be assigned to effect a specific part of the sound. Certain assignments are *common* to all elements and others can be specific to a particular *element* of the sound. There are 6 Control Sets each allows the user to pick a hardware, or physical, controller and assign it a parameter destination (parameter you are changing). It is possible with this system to assign more than one controller to the same destination. And it is also possible to have a single destination under the control of more than one physical controller. The degree or *depth* of the control of each physical controller can be programmed, as well.

You can view and set the parameters for the Controller Setups in the S80 itself or via the S80 Editor in your computer. To navigate to the Controller Sets in the S80 from **Voice mode**: Select a sound from either PRE1, PRE2, INT, or EXT banks;

- Press [EDIT]
- Use the MENU feature to select the Controller pages: Hold [SHIFT] and turn the PAGE knob to select Common:CTL. Or use the shortcut button [4] – the shortcut button acts like a bookmark. There are 6 pages in this section: CTL Set 1 – CTL Set 6.
- **Setting the SRC/DEST:** Use the knobs to select a source (Src) controller and assign a target destination (Dest) parameter.

◆CTL Set 1 >	Src	Dest	EL Sw	Depth
☰ 1---	MW(01)	off	(----	+00

- **Control Elements or Common:** The EL Switch or Element Switch activates control for each element. If the destination is 'common' to all elements you will see parenthesis (----) around the four dashes that represent the individual elements. Parenthesis around a parameter means you cannot get at it (grayed-out). In this case because all individual elements will be treated together. Common parameter destinations are like Volume, Reverb Send or Chorus Send. If the destination can be assigned to a specific Element(s) you will see the destination parameter name as **ELM-Lvl** = Element level, **ELM-Dly** = Element delay, or **ELM-Pan**, etc. You can

select which elements are to respond to this control setting. An "EL Sw" Element Switch setting of "-2--", represents a setting where element 2 will be effected, and the others are off. (See example assignment below).

- **DEPTH** The setting here must be set with care and some thought. The range here is -64 ~ 0 ~ +63. How the S80 responds to a setting will depend on *which parameter* and *which controller* is selected. (See below some example assignments). A Depth setting of 0 defeats all other settings in the Controller Set (and renders them meaningless). In general, the higher the number the more it increases the range of control. Positive and negative settings reverse the effective direction of the controller.

**Example Assignment:** In this example we deal with controlling VOLUME via controllers within an S80 sample-based Voice. This can be tricky, but this example should make it clear how it works.

--Let's say you want to control the **total** Volume of the Voice with the Modulation Wheel. MIDI control change message #001 is the Modulation Wheel. The modulation wheel can be assigned to control all manner of parameters within a synthesizer, not just vibrato. But for our example let's see what happens when you attempt to assign the MW to control overall volume. For our experiment let's initialize a voice. This way we are not inheriting values from a preprogrammed Controller Set. From **Voice mode**:

- Press [JOB]
- Use the PAGE knob, if necessary, to navigate to the "Initialize > Current Voice" screen
- Press [ENTER] and [INC/YES] to execute
- Press [EDIT]
- Let's select a synth wave. Navigate to the OSC page. (Shortcut: press Program button 9 and use the PAGE knob, if necessary)
- Select sample wave #244 [Wv:ModSaw ]

▼OSC Wave)	Number	Ctgr
EL1---	▶ 244	[Wv:ModSaw ]

- Now, for fun, lets activate a second element in this Voice. With KN A select the '-' dash that represents element 2 or shortcut: Touch the [B] Bank button.

- Using KN C set element 2 to waveform #257 [Wv:Mog Bs3]

▼ OSC Wave) Number Ctgry
EL12-- ▶ 257[Wv:MogBs3 ]

- You can use Bank buttons [A], [B], [C], and [D] to **select** elements, and buttons [E], [F], [G], and [H] to turn them **on/off**. Try it!
- Navigate to the CTL Set 1 (Control Set 1) page. (Shortcut: press Program button 4 and use the PAGE knob, if necessary)
- Set the CTL SET 1 as follows:

◆ CTL Set 1> Src Dest EL Sw Depth
C 12-- MW(01) Volume (----) +63

In the above example, the volume parameter is common to **all elements**. (If you were to activate additional Elements they would also share the same setting when you select a 'common' destination.) The modulation wheel will effect all the elements. The **+63** Depth setting sets the maximum range of the controller. Try it...move the mod wheel...

Hey! What gives...I thought I would now be controlling the volume completely with the modulation wheel! But **no**, it **doesn't** work. Is the unit broken? Should I call someone? - Not at all. Here's why it is not working: This is not the place that the overall volume of the sound is set, only where you **assign control to it**. We need to go to the overall Voice volume parameter and reduce it to zero. Here is how. Navigate to the QED Level (Quick Edit Level) page. (Shortcut: press Program button 2, then use the PAGE knob, if necessary). Here you will see a parameter for the total volume of the Voice = 127. Program it to 0. That's right, 0. (See screen below).

◆ QED Level> Vol Pan RevSend ChoSend
C 12-- ▶ 0 C 40 0

Now when you move the modulation wheel you have **total** control over the volume of the Voice. The position of the modulation wheel is now an *absolute* representation of the current common volume, 0-127. We call this process 'biasing' the parameter (in this case, volume) to the controller. In other words, it will now look to this controller (mod wheel) for volume instructions.

Similarly, a volume assignment can be made on the element level. This would allow the

player/programmer to have control over specific sounds (elements) within a Voice. Instead of making the Destination = Volume (common overall volume) like before, this time assign it to **ELM-Lvl**. When ELM-Lvl is selected you can individually assign which elements will respond to this Control Set's Depth setting when the physical controller is moved. (See screen below). Select 'ELM-Lvl' via KN C. The screen shows a Voice that has 2 active elements, however, only element 2's level is being controlled via the MW (Element Switch).

◆ CTL Set 1> Src Dest EL Sw Depth
C 12-- MW(01) ELM-Lvl -2-- +63

Fig: To turn off/on Element Switches turn KN 1 to make the corresponding dash '-' flash, then use the [INC] and [DEC] buttons to turn on/off.

And in a similar fashion you would need to set the initial level of the element(s) that you are controlling to zero (bias its level to the MW). This is found on the Oscillator Output page:

◆ OSC Out> Level Delay InsEF
EL 12-- ▶ 0 0 thru

Fig: Touch button [9] and turn the PAGE knob to see the OSC Out page. You can now move back and forth between the Element OSC Level page and the Common Control Set page by turning KN A.

When you set Element 2's Level to 0, it is biased to the MW. This is a very flexible arrangement. You can expand upon it and dream up your own configurations. For example, you could take Control Set 2 and program it to control just Element 1 with the same Mod Wheel but set the ELM-Lvl DEPTH to -64. Now when you move the wheel it will fade out one sound and fade in the other.

A similar scenario occurs when you assign a Voice to Breath Control. You want the Voice to only pay attention to (be biased to) input from the Breath Controller (cc #002). In such a case you will want to reduce the overall volume of the Voice (in QED Level) to 0 or the element level to 0. Which one you use will depend on what it is you are trying to accomplish. This way the volume will be entirely determined by the amount of breath pressure applied to the BC3. Note-ons **do not** turn the sound on alone. They must be accompanied by a burst of breath (air) pressure (cc #002) applied to the mouthpiece.

**Note:** It must be stated here that Breath Control works best of all on VL physical modeled voices (optional PLG150-VL board). The Virtual Acoustic

technology is meant to respond perfectly with breath control input. In the technology there is an acoustically accurate change in timbre, pitch and amplitude in response to BC 'pressure' control. The sound of VL will mimic the 'behavior' of acoustic instruments. When controlling non-VL type voices you might try assigning breath control (BC) to vary the cutoff frequency of the filter. In such a case you may want to program the initial value of the filter to something other than zero – set to taste. This would require you to go into the Voice element level and set the cutoff frequency of the filter for each element you want to control. (Shortcut: Press program button 11 to see element level filter settings) Each element can have a different filter type and cutoff/resonance. In our example we have just one element but each element that you add can have its own filter and filter settings.

The same scenario holds true for controlling volume with a Yamaha FC7 (sweep control pedal) plugged into the **Foot Control** jack. Foot Control (cc #004) can be assigned to control many different parameters within a synth voice. (Not to be confused with Foot Volume (cc #007) which always defaults to controlling MIDI Channel Volume). There is always some confusion here because they both use the same FC7 pedal – however, the function can be quite different. Foot Control can be reassigned to control the internal volume of the S80. Simply follow the steps above to assign the Foot Controller FC to be the (SRC) source and set volume as the (DEST) destination. When you set the QED Level (Quick Edit Volume) to 0 you will have biased total volume to the Foot Controller.

**Note:** If the parameter to be controlled is set at any value other than 0, you are, in effect, setting a *minimum value*. In the case of our volume example, this would be the minimum volume when the controller was in the heel down position. In some instances you may wish to set the minimum to a value other than zero as the stored condition. The example above is useful in a scenario where you want to control the internal S80 sound with a separate foot pedal from what is sent via MIDI.

After any and all Voice edit procedures you should save data (if it is worthy of keeping). If you started editing a Preset or you started editing an Internal Voice, simply point the Store procedure towards a desirable Internal (or External SmartMedia) storage location. All storage is to user RAM banks: either INT Internal 1-128 or EXT (if a SmartMedia card is present) External 1-128. Press [STORE]; Select a location; press [ENTER]; then [YES].

**Note:** At the end of any editing session you should make a backup copy of all your new Voice edits.

Save sounds either to the optional SmartMedia card in ALL or ALL-VOICE files or backup the current set via a S80 Voice Editor in XGworks or create a bulk dump file.

### What things can be assigned

To answer this question we must recognize that there are answers for internal Voices/Performances and answers for external communication via MIDI Master Keyboard setups. But first, let's gain an understanding of how the controllers work. MIDI provides for standard physical controllers. Some are fixed as to what control change message they send, while others are assignable. We must consider what these controllers are doing to the internal S80 sounds and what they are doing out via MIDI. These two things can be quite different, by design.

First, here is how it works with Voices. S80 PRE1, PRE2 and INT Voice banks hold the factory programmer's best work. These are your fundamental, playable sounds. A Voice can have as many as 4 completely independent sample waveform sets within it – Yamaha calls these components *Elements*. Each Element can be individually controlled by S80 parameters such as filters, envelopes, LFOs, etc. You can assign the various physical controllers to control specific areas within the sound. The physical controls available for assignment are:

- PB** – Pitch bend wheel
- MW** – Modulation wheel
- KN 1** – Knob 1
- KN 2** – Knob 2
- AT** – Aftertouch
- FC** – Foot Control
- FS** – Foot Switch
- BC** – Breath Controller
- RB\*** – Ribbon Controller (CS6x)
- FV** – Foot Volume
- SUS** – Sustain
- KN A** – Knob A
- KN B** – Knob B
- KN C** – Knob C

**Control Sliders 1 / 2 / 3 / 4**

**PB** – Pitch Bend wheel will always send information that is Pitch Bend data (its own category of message) both internally and out via MIDI. How this data is interpreted by the tone generator, is programmable. For example, it is possible to use the wheel for something other than just pitch bend by programming the sound to have a pitch bend depth of 0 and then assigning the PB wheel to a different parameter. For example, in physical modeling VL technology (PLG150-VL) the PB wheel is often used for embouchure (mouth position/tightness of the lips). It makes a good control for this because the embouchure can

be tightened (wheel up) or loosened (wheel down) or returned to normal (centered). These Voices are often programmed such that the PB range = +0.

**MW** – Modulation wheel will always send control change message 001 and this data is typically used for vibrato depth both internally and out via MIDI. How this data (control change message 001 – written cc001) is interpreted by the tone generator, is programmable. For example, it is possible to use the modulation wheel for something other than just vibrato depth by programming the sounds PMD (pitch modulation depth to 0) and assigning it another parameter. (PMD is another name for vibrato.) For example, the mod wheel makes a good mix control. You can use it to fade one layer *in* (+ depth) while a second layer is programmed to fade *out* (-depth).

**KN 1** – Knob 1 does not have a fixed message. It can be assigned as an internal control device. You can use Knob 1 to change element level, filter cutoff/resonance, effect send, etc., etc. It can **independently** be assigned **any** control change message, (cc0-cc95), for transmitting out via MIDI. The default assignment is cc #016 called: General Purpose control 1. If you reassign the default Knob 1 control change assignment (global setting found in UTILITY) to cc #001 Modulation Wheel, for example, you will in effect have a modulation wheel on a knob.

**KN2** – Knob 2 does not have a fixed message. It can be assigned as an internal control device. You can use it to change element level, filter, effects, etc., etc. It can **independently** be assigned any control change message for transmitting out via MIDI. The default assignment is cc #017: General Purpose control 2. If you reassign the default Knob 2 assignment (global setting found in UTILITY) to cc #002, for example, you will in effect have a breath control on a knob.

**AFTERTOUCH** – will always be sent when extra pressure is applied to the key. How this controller data is interpreted, if at all, is a function of the voice parameters in the tone generator. Some players use aftertouch to vary PMD (pitch modulation depth), vibrato. Others like it to brighten the sound and assign it to filter cutoff.

**FOOT CONTROL** – defaults to sending control change message 004, but can be reassigned to

any control change number 0-95 (global setting found in UTILITY). How this data is interpreted by the tone generator, is programmable. For example, it is possible to use the foot control for filter cutoff (wah-wah) on an internal sound and have an external sound set to interpret cc #004 as something entirely different.

**FOOT SWITCH** – Use a Yamaha FC4 or FC5 (sustain like switch). It can be assigned any cc number between 0-100. It will always send a control change value of 127 when activated; otherwise the value is 0. The nature of the switch makes it ideal for OFF/ON operations. This message can be used to turn something from off to on or vice versa. The default assignment is cc #088 an unassigned number. Assigned to cc #099 or 100 you can advance or move backward through Voices or Performances. You could even use it to start/stop the arpeggiator (cc90\*), hold the arpeggiator (89\*) or the sequencer (cc98).  
\*The S80 default for Arp Sw and Arp Hold.

**BREATH CONTROL** – defaults to sending control change message 002, but can be assigned to any cc number from 0-95 (global setting found in UTILITY). How this data is interpreted by the tone generator, is programmable. For example, in VL Voices (PLG150-VL) breath control often applies Pressure to the mouthpiece (or driver), and can be responsible for parameters like Scream and Throat Formant.

**RIBBON CONTROL** – you may have noticed that the S80 does not have a physical ribbon controller (its sister the CS6x does, however). The Ribbon of the CS6x uses cc #022 as its default – this is normally an unassigned number. If you load in CS6 Voice data you may find certain parameters assigned to controller 22 – these would be for the CS6x Ribbon. The RB setting in the S80 can be used like an **AC** or assignable control number rather than a physical control (in fact, think of it like an assignable control). For example, you may have sequence data originally done on an EX5 or VL1, where control change message 13 was used as the default assignment for Modulation Wheel #2. By assigning RB cc message 13 and then assigning a similar destination for control and you can set the S80 up to respond like the EX5 or VL1 settings.

**FOOT VOLUME\*\*** – will always send either control change message 007 (**volume**) or 011 (**expression**). The Foot Volume pedal is not

available as an assignable or re-assignable controller, beyond cc007 or cc011. You select which it will send globally for the S80 in UTILITY> CTRL Other. The default is 011 (expression). Many people mistake these two as being the same thing. While they both control how loud, they have different functions. For example, in a Performance Multi you plan to play a B3 Voice on top of a sequenced rhythm section. When you set the mix volume of the organ Part on the "MIX Level" page at a volume level of 96. (Because 96 is the perfect setting for as loud as you ever need to be). You are setting how loud the organ sound will play on a scale from 0-127 - relative to the other sounds. If your FV pedal is set to control 011 (expression) – toe down will never exceed the '96' volume setting of the Part. If, on the other hand, you have the FV assigned to cc007 (volume) the volume will be set by the absolute position of the pedal – toe down will reset the volume to 127 – and you will be too loud. Expression (cc11) is **relative** volume within the maximum set by the individual parts Level. Volume (cc07) is **absolute** volume for the current MIDI channel.

**SUSTAIN** – will always send a control change message 064. This control number is HOLD 1 and will latch the current sound. (Other controllers can be assigned to send cc064 sustain but a pedal plugged into the sustain jack will always send sustain). Whew!

**Knob A / B / C** – default to cc18, cc19 and cc20, but are assignable to any control change number. Additionally, they can be assigned to System Controller Destination parameters (Master EQ, Arpeggio, Quick Edit, and other global parameters). These are assigned globally in UTILITY mode. The default assignments have these 3 knobs controlling Low Gain, Mid Gain and High Gain of the S80's 5-band Master EQ (a powerful parametric equalizer).

**CONTROL SLIDERS 1 / 2 / 3 / 4** – default to controlling volumes in both Voice and Performance modes and are assignable per zone in a 4-zone Master Keyboard setup. (See separate section below). In Voice mode you are always controlling Element levels 1-4, while in Performance the default is Voice volumes. In a Master Keyboard setup they are individually programmable – CS 1 will be for zone 1, CS 2 for zone 2 and so on. But you select the parameter they control.

**Control Sets:** Each AWM2 (sample-based) PRE1, PRE2, INT, and EXT S80 Voice has six Control Setups where a physical controller, called the source (SRC), is assigned a specific controllable parameter, called the destination (DEST) and a depth value that determines how much effect the controller will have. This flexible system will enable the user to tailor the sensitivity of each controller's movement. Sensitivity refers to how far you move the controller to get a desired result. This is an important setting because you want to be comfortable working the controller while you perform.

The destinations are listed in detail on page 15 of the Data List booklet that comes with your S80. They include Voice volume, reverb send, chorus send, and some 26 Insertion Effect parameters. And if you are dealing with sample-based sound Voices, an array of common and individual element parameters like filter cutoff, resonance, LFO speed and depth, tuning, key on delay, Pan position, Pitch, Filter and Amplitude envelopes, etc., etc., can be programmed. PLG1 and PLG2 Voices will be able to be assigned to volume, reverb send, chorus send and the 26 possible Insertion Effect parameters, **only**.

Each PLG-series board may have controller sets of their own, depending on the technology involved – these will be programmed in the PLG Voice Editor software. For example, if you program (using the provided AN Expert Editor) a PLG150-AN Voice to respond to cc16 for filter cutoff and cc17 for filter resonance, it will have its 'virtual analog' filter controlled by the S80 assignable Knobs 1 / 2.

**Note: PLG150-series** Plug-in Voices will have a different set of Controller Set screens in the S80 (explained below). Also, look in the Voice Editors for additional assignable controller routings. For example, the AN has some 8 AC (assignable control devices) available – the AN1x had 8 assignable knobs – you can reassign as many as you wish to your available physical controllers. Each board will have a different controller setup arrangement depending on the technology involved.

The PLG150 Voices will have the following additional Controller (CTL) screens that will let you route controllers to the following areas:

**Modulation Wheel Assignment:** In each S80 PLG Voice you can assign MW to directly control the Filter (cutoff/resonance); Pitch Modulation (PMod) – vibrato; Filter Modulation

(FMod) – wah-wah; and Amplitude Modulation (AMod) - tremolo.

**Aftertouch Assignment:** Aftertouch can be assigned to Filter, Pitch Mod, Filter Mod, Amplitude Mod and the direct control of Pitch with (AT) key pressure

**Assignable Controller:** For each PLG150 Voice you will find a screen for an Assignable Control – CTL AC Control. Here you can pick a device (physical controller) or control change number to do various tasks: Control the Filter, Pitch Modulation, Filter Modulation, and Amplitude Modulation. These will enable the user to customize routing for the PLG150 Voices.

### Understanding how the Controller and the parameter ranges work:

Put on your thinking caps...this is tricky. Minimum-to-Maximum controls versus Negative-to-Positive controls: Consider the Mod wheel versus the Pitch Bend wheel as a physical control device. One has its zero position in the middle, while the other is at zero in the down position. One changes values from minimum towards maximum, the other above and below a 0 center value. These factors must be considered when you make an assignment of a parameter to a physical control. Think about all physical controllers in these two groups:

#### Minimum to Maximum Controllers

Modulation Wheel  
Foot Controller  
Breath Controller  
Aftertouch  
Foot Volume  
Control Slider 1/2/3/4  
Foot Switch/Sus \*min. or max. only

#### Negative ~ 0 ~ Positive Controllers

Pitch Bend Wheel  
Ribbon Controller  
KN 1/2  
KN A/B/C

Now think about the parameters and the range of possible values. Some parameters go from minimum to maximum (like volume and effect sends: 0-127) while others move above and below a center zero point (pan position: L-C-R), and filter cutoff: -64 closed, 0 normal, +63 open).

This can be an issue if, for example, you assign a **minimum to maximum** parameter, like **volume 0-127**, to a **negative to positive** controller like **Knob 1**. Here's what happens:

The 12 o'clock position will be 0 volume, while +63, the 5 o'clock position, will be maximum volume. For all settings left of 12 o'clock, 0 through -64, the minimum volume is sent out, 0. The control seemingly only works half the time. You can't hear less than 0.

It is **not** an issue when you assign a negative/positive parameter, like pan position, to a negative/positive controller like a Knob or Ribbon. In such a case, negative values pan left and positive values pan right.

Conclusion: Consider this when selecting a controller for a specific parameter.

### The Control Sliders

There are 4 Control Sliders. We need to talk about their function in Voice, Performance and Master Keyboard modes.

**Voice Mode:** (PRE1, PRE2, INT, EXT) Voices: The sliders are sending Element Level (via system exclusive messages). In Voices that combines up to four (sampled) elements you have a slider for each element. In a Voice like (**PRE1: 006 (A06) Piano/EP**) sliders 1 and 2 control the electric piano and sliders 3 and 4 control the acoustic piano. Note: PLG Voices - In Voice mode the sliders have no effect.

**Performance Mode:** The sliders are sending Voice Level (again via system exclusive messages – that will effect only the S80, not out via MIDI). In a Performance Layer that has up to 4 Voices (example: INT: 001 (A01) AGE2000NEW) each slider controls the volume of one of the Voices. When the LAYER switch is ON for a PART – the slider will control the Voice volume (whether the Voice Layer is sampled or PLG). Performance Layers can combine (PRE1, PRE2, INT, EXT) Voices and PLG\* Voices. \*one per board

**Master Keyboard Mode:** The sliders are assignable to any control change number from 0-95, when you are setting up a **4-zone** setup. You determine what each slider sends to each corresponding zone. You determine the MIDI channel and destination (internal TG or MIDI or both) for each zone. The default is cc #007 (volume) for each zone and this is sent out via MIDI (if you want). Controllers can be activated or deactivated per Zone.

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