YAMAHA

POWER USER

MUSIC PRODUCTION and PERFORMANCE

MOTIF-RACK ES
## CONTROL SETS and Beyond

Assigning MIDI Controllers

Phil Clendeninn
Senior Product Specialist
Technology Products
©Yamaha Corporation of America

This article can only hope to help you get started. You will have to refer to the Owner's Manual of your controlling keyboard to find out what physical controllers and Control Change (cc) messages are available to be sent to the Motif-Rack ES. You will discover that certain physical controllers are fixed as to the message that they send (PB, MW, Sus and AT) but in the main you are free to program what the receiving device does with that control message. Other physical controllers may be assignable as the message they send (FC, BC, Knobs, Sliders, Ribbons, etc.). Each internal Motif-Rack ES Voice has six CONTROL SETS – each allows you to assign controllers (sources) to any of 68 possible destination parameters. You also have two Assignable Control destinations that can be set globally (85 Destinations). Please refer to the Motif-Rack ES DATA LIST booklet for pertinent information (page 43). As with all the Power User Guides, it assumes you are following along making the button pushes as your read the document – this will maximize its effectiveness.

Control Sets

In the article "Introducing Motif-Rack ES EFFECTS" we mentioned assigning real time controllers to parameters within a Motif-Rack ES Voice, in particular to control the Dual Insertion Effects. Voice mode is the mode of the Motif-Rack ES where the principal programming was done. We talked about the difference between System Effects and Insertion Effects. Insertion Effects are routed 'in-line' with the signal from each VOICE Element. You will be able to control many (but not all) parameters of the Insertion Effect in real time. You can assign control to the System Effects, but as we will learn, your control is limited to SEND level only from the Voice Control Sets. You can be very particular about controlling the sound you are playing. Control Sets not only let you control the Insertion Effect parameters directly, and the send levels to Reverb and Chorus, but they let you control other aspects of the sound like filter and envelope settings at the Element level. Each Voice has six Control Sets that are customizable on a per Voice basis.

You will find a listing of the 68 parameters you can control within a VOICE on page 43 of your Data List booklet: "VOICE CONTROL SET DESTINATION". Take a look at this list and you can see that your options are many. We will be talking about NORMAL Voices; as we will see later, it is a bit different for Drum Voices and Plug-in Voices. If a parameter is not available it is because it is not *musically* useful – this is a judgment call made by the engineers when the unit was designed. If changing a certain parameter causes an ugly zipper noise, then you will probably be prevented from changing it. It is common sense, really. You will have to take inventory on your controlling keyboard for the available physical controllers when you are ready to make assignments. Let's begin by studying a VOICE that already has Control Set assignments and see how this all works.
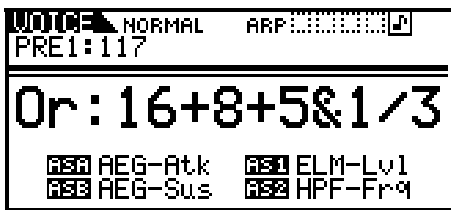

The organ Voice shown above, PRE1:117 "Or:16+8+5&1/3", has certain of the assignments visible from the main screen. ASA, ASB, AS1 and AS2 refer to controller assignment devices.

- Press EFFECT:
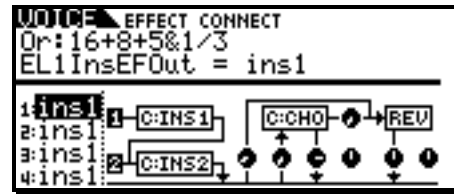
In the EFFECTS 101 article we learned how to explore the assigned effects. If you press the EFFECT button it will toggle between the EFFECT CONNECT screen (shown above) and the Effect EDIT screen – where you can alter settings of the current Effect type. Once you have selected the EFFECT CONNECT screen you can use the PAGE [<]/[>] buttons and the UP/DOWN cursors to navigate the effect routing.
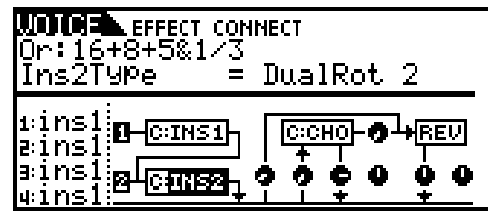

When you highlight a processor (box) INS1, INS2 (shown highlighted above), CHO and/or REV you can see (on line 3) what Effect algorithm is selected for that processor. This is how you can learn that the effects assigned to this Voice are as follows:

INS1: 3-band EQ
INS2: Dual Rotary Speaker 2
CHO: Chorus 1
REV: Hall 1
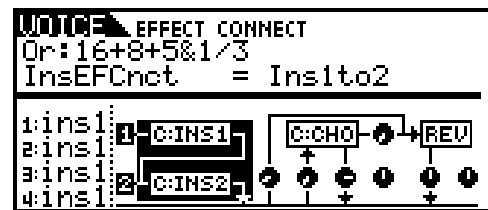
You can also learn from this screen, the routing of the INSERTION effects. The possibilities are INS1→INS2 (as shown), INS2→INS1 and Parallel. The four elements of this Voice are all routed to Insertion Effect 1 (ins1). INS1 is routed to INS2 and then on to the main flow (left to right across the bottom). The important thing to note is that on a per Element basis (an element being a multi-sample in the case of the internal sounds) can be routed independently to the Insertion Effects block. This can be very useful when making combination type Voices. In the screen shot above the Insertion Effect Connection is highlighted.
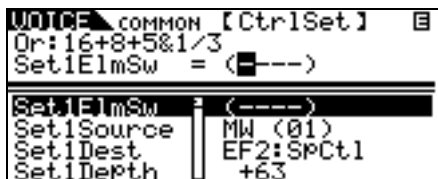
```
VOICE  EFFECT CONNECT
Or:16+8+5&1/3
ReverbSend  =   10

1:ins1
2:ins1
3:ins1
4:ins1
```
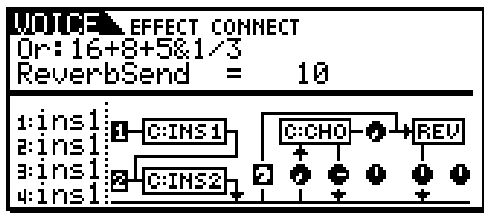
Signal flow direction ————————————►

If you highlight a knob icon in the EFFECT CONNECT screen you can view its function and change its value. You have Reverb Send (shown highlighted above), Chorus Send, Chorus Return, Chorus Pan, Reverb Return, Reverb Pan, and finally in between the Chorus and the Reverb you have a send level control. When you highlight a processor you can hit the EFFECT button again to drop down a level and edit its parameters. Refer to the DATA LIST booklet for a complete listing and translation of the Effect parameters. If you plan on mastering the Motif-Rack ES take the time for familiarize yourself with the abbreviations.

Now, on to the **CONTROL SETS**, which are found in the EDIT area:
- Press [EDIT]
- If COMMON is not showing on the top line of the screen, press [SHIFT]+[COMMON] to select VOICE COMMON parameters.
- PAGE [<] or [>] to the "CtrlSet" screen (shown):

```
VOICE  COMMON [CtrlSet]    ▤
Or:16+8+5&1/3
Set1ElmSw = (■---)

Set1ElmSw   (----)
Set1Source  MW (01)
Set1Dest    EF2:SpCtl
Set1Depth     +63
```

Explanation: "Set1ElmSw = (----)" translates into Control Set number 1 Element Switch. You can activate items per Element – an Element is a single part of a Voice – a multi-sample in the case of the internal sounds. In this particular B3 sound there are 4 Elements. You can isolate an Element by turning them on and off via the MUTE button – when the [MUTE/SEL] LED is lit, the lighted buttons a row under it represent the Elements in this Voice. You can isolate them to determine: Element 1 represents the 16-foot organ flute, Element 2 represents the Percussion sound, Element 3 represents the 5&1/3 organ flute (musical 5th), and Element 4 represents the 8-foot organ flute (Jimmy Smith's favorite setting). The four dashes in parenthesis (----) next to the Element Switch means the parameter that is selected is not a "per Element" parameter but one that will effect *all* Elements together. If no parenthesis appear you will be able to select

which of the Elements is to respond by turning the Element number on…it all depends on the parameter you select to control. When you look at the list of available parameters in the DATA LIST booklet you will see that some parameters are "ELM" (Element) parameters and others are "C" (COMMON) parameters, like "CLFO" is the Common Low Frequency Oscillator. This happens to be a parameter all Elements will share in Common.

"MW(01)" Modulation Wheel is assigned controller #01 by convention. This is the SOURCE. SOURCE means the actual physical Controller. The DESTINATION is the parameter being changed by the Mod Wheel: "EF2:SpCtl" which translates to INSERTION EFFECT 2, Speed Control. The DEPTH parameter determines the range of control that the MW will apply. A range set at +63 is the maximum. This affects how far you have to move a controller to get the desired effect and it effects the direction of effectiveness. In this case it is a switch, i.e., FAST/SLOW – once you pass half way you flip the switch. The full scope of the Depth parameter is minus 64 through plus 63 (128 steps). A positive number will determine the direction of movement of the controller, with "+" numbers being the normal direction of movement. A Depth setting of +0 will negate all other parameters in the Control Set. On most keyboards the modulation controller is a wheel and it is at minimum when down and at maximum when moved upward. Some keyboards have a spring-loaded modulation controller, however. You will have to determine what controller "gets the job done" for you. In this assignment a Modulation *Wheel* makes sense because you can move it up and speed up the rotary speaker – this would be problematic for a spring-loaded modulation controller because you would have to hold it there for the 'fast Leslie' effect.[1]

What all this translates into is when you move the Modulation Wheel or send Control Change message 001 from your sequencer, this particular organ Voice will change the Speed Control of INSERTION EFFECT 2 - which is the Dual Rotary Speaker2 effect type. Cool. If your controller sends Aftertouch, change the MW(01) to AT and press down on the keys. You have reassigned the SPEED CONTROL to Aftertouch (key pressure). This is how controller assignments are made. Again it is your choice as to whether or not this works for you as a player. You may find it difficult to maintain pressure on the keys to maintain the 'fast Leslie' effect. If you have an assignable foot

---

[1] If your controlling keyboard has a spring-loaded controller, you may want to make a new assignment for this function.

controller you can select FC(04) as the speed switch. If you highlight the SOURCE parameter you can see that your choices are as follows:

PB Pitch Bend
MW(01) Modulation Wheel
AT Aftertouch
FC2(04) Foot Control 2
FS(88) Foot Switch
FC1(11) Foot Control 1
RB(22) Ribbon
BC(02) Breath Control
AS1(16) General Purpose Control 1
AS2(17) General Purpose Control 2

The numbers in parenthesis denote the current assignment for that controller. These control change (cc) numbers are customizable globally for VOICE mode. Pitch Bend and Aftertouch are their own category of MIDI control message. The other controllers shown above are in their default (or factory) settings. If, for whatever reason, you need to change these you will find the parameters for this in UTILITY. You must enter UTILITY from VOICE mode:
- Press UTILITY
- Use the PAGE [<]/[>] buttons to select the VOICE screen

If you scroll DOWN on this screen you can view the assignments for Arpeggiator Output, Arpeggio Transmit Channel, AS1, AS2, BC, RB, FC1 and FC2:

Assignments made on this "VOICE" screen apply to VOICE mode. You can change the assignment for these according to the available controllers on your keyboard controller. If, for example, you have a Motif ES or S90 keyboard as a controller, these numbers and assignments conform to the available controllers. Your controller may have different Control Change numbers for its own physical controllers – please check the documentation for your particular controller.

The Voice Mode "Arp Output Switch" will allow you to transmit the result of the arpeggiator to the MIDI output and you can select a MIDI transmit channel for the output of the arpeggiator. Remember an Arpeggiator is set of prerecorded note patterns and/or controller information that, when engaged, triggers a musical phrase without requiring that the player actually perform the phrase in real time. Arpeggios can be up and down note flourishes, finger picked guitar gestures, drum grooves, flute trills, Cuban montuno piano grooves, synth bass lines with filter sweeps, etc. In the Motif-Rack ES, the arpeggiator is not just a simple note flourish: It can be a complete musical gesture. Data generated in conjunction with the Arpeggiator can be divided into the note data that is input (trigger notes) and the note data that is output (arp out). These can be sent on different MIDI channels to the MIDI out.

The FS (Foot Switch) is a global assignment. It will apply for VOICE, PERFORMANCE **and** MULTI modes. You can assign the Foot Switch to any controller number between 0~95 (except 0 and 32 which are reserved for Bank Select). You can view these truly global assignments by paging to the right one screen to the "CtrlAsn" screen. This is where you find the assignment for the arpeggiator switch, arpeggiator hold, ASA, ASB, and the Foot Switch. You can change the FS assignment as you like.

If you do not have a physical control for each of these items do not worry. Some of these you can use from within your sequence data. You don't need to change everything in real time with a controller. Select those things that are important for your particular needs.

What about real time control over the arpeggios?
The Motif-Rack ES has a huge library (1787) of arpeggios, including the Keyboard Mega Voice arpeggio phrases from the Motif ES keyboard. Up to 5 arpeggio Types can be associated with any VOICE, PERFORMANCE or MULTI program. You

can select the current arpeggio from your controller or the front panel of the Motif-Rack ES. Additionally you can control the following attributes of the arpeggio in real time with controller assignment: Unit Multiply, Velocity Rate, Gate Time Rate, Quantize Value, Quantize Strength, Swing Percentage, and Tempo.
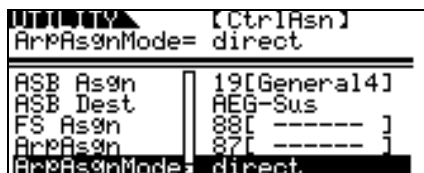
```
UTILITY       [CtrlAsn]
ArpAsgnMode= direct

ASB Asgn     19[General4]
ASB Dest     AEG-Sus
FS Asgn      88[ ------ ]
ArpAsgn      87[ ------ ]
ArpAsgnMode: direct
```

In the screen shot above you will see "ArpAsgn" and "ArpAsgnMode" – this allows you to select a controller number (device) and the movement of that controller will either directly (direct) change or step through (inc) the 5 associated arpeggios.

What are ASA and ASB? And what are AS1 and AS2? They stand for Assignable A, Assignable B, Assignable 1 and Assignable 2. These are control devices. You can select a control change number and a 'destination' parameter that will be controlled by this number. The A and B are **global** for the Motif-Rack ES. How they are assigned will be true in each program you recall. The Assignable 1 and 2 devices are assignable to different destinations **per** program. By default (from the factory) these are set as follows:

ASA is set to control change number 18 (General Purpose Control 3) and is set to change the "AEG-Dcy" or Amplitude Envelope Generator Decay parameter. When you assign a controller on your controlling keyboard to send Control Change (cc) message #018 it can change a particular target parameter in the Motif-Rack ES. The programmer's selected the Decay portion of the Amplitude Envelope – the **D** in the A**D**SR (attack-decay-sustain-release). Refer to the DATA LIST booklet for other ASSIGN A/B DESTINATIONS.

ASB is set to control change number 19 (General Purpose Control 4) and is set to change the "AEG-Sus" or Amplitude Envelope Generator Sustain parameter. When you assign a controller on your controlling keyboard to send Control Change (cc) message #019 it can change a particular target parameter in the Motif-Rack ES. The programmer's selected the Sustain portion of the Amplitude Envelope – the **S** in the AD**S**R.

-ASA and ASB Destinations as outlined on page 43 of the DATA LIST booklet include parameters of the 5-band parametric EQ, parameters of the System Effects Reverb and Chorus including the Returns and Pan position of the effects and the Send Chorus→ Reverb, Arpeggio Quantize and Play Effects, ADSR of the amplitude envelope generator and the ADR of the filter envelope generator and Filter EG Depth, cutoff frequency and resonance. That's some 85 destinations in all. These are global settings however. This means they will apply to all programs. So spend so time thinking through what is important for *your* particular need. You can decide what control change number they are assigned, but they will always address the same parameter no matter what mode or program is current.

AS1 is set to control change number 16 (General Purpose Control 1) and is not set to change any specific parameter. When you assign a controller on your controlling keyboard to send Control Change (cc) message #016 it can change a particular target parameter in the Motif-Rack ES – one that you select **per** program – in one of the six Control Sets per Voice.

AS2 is set to control change number 17 (General Purpose Control 2) and is not set to change any specific parameter. When you assign a controller on your controlling keyboard to send Control Change (cc) message #017 it can change a particular target parameter in the Motif-Rack ES – one that you select **per** program – in one of the six Control Sets per Voice.

-AS1 and AS2 are assignable devices and although you decide what control numbers they are assigned, you determine per Voice what parameter they are assigned to control. When multiple Voices are played simultaneously (Performance mode) a single knob (AS1, AS2) could be doing different things to each layer.

Controllers in a MULTI
By now you are familiar with Voice mode and Multi Mode. Performance mode can layer multiple Voices for real time play – all Voices and Performances are communicated to on the *Basic MIDI Receive* channel of the unit. You can set up a Multi for multiple MIDI channel play like when you are using a sequencer to playback multiple Voices on different channels. Or you can combine these two functions: that is, setup a Multi that allows you to play multiple Voices on a single MIDI channel, while the sequencer plays the others on different channels. In fact, you can copy a Performance with its Parts, Arpeggios and Effects to a MULTI – it will use up to the first four Parts of the Multi. It simply assigns them all to the Basic Receive channel of the unit.

Each PERFORMANCE and each MULTI setup is autonomous when it comes to Controller Setups. Each Voice in a Multi is placed in an entity called a

PART. Each Voice in a Performance is place in an entity called a PART. Each Part can have a unique relationship with its controllers. In fact, it can get quite complex. Multiple Voices layered together can respond in a very complex manner because each layer could do something different to the movement of a single control. One Voice might be programmed to increase in volume in response to a controller's positive movement, while a second Voice might be programmed to decrease in volume in response to that same controller's positive movement. Within a MULTI or PERFORMANCE you have the ability to "filter" (prevent) a controller from affecting a specific PART. There are limitations, of course. For example, we talked about being able to control certain parameters in real time – particularly those within the Insertion Effects. The Motif-Rack ES will allow you to recall Insertion Effects on eight PARTS of the MULTI (all four Parts of a Performance) and therefore these Parts will be able to be controlled via their respective controller routings assigned to Insertion parameters. This does not mean that the other Parts do not respond to controllers, no, not at all. It means that real time control of Insertion Effects is limited to the selected Parts. Assignments to things like Reverb Send, Chorus Send, LFO control, Cutoff, Resonance, Element Volume, Main Volume, etc., etc. can still be controlled by various controller assignments. The integrity of what was programmed at the Voice level is maintained when the Voice is placed in a PART. The only limitation is on the number of Insertion Effects that can be active at once.

Volume vs. Expression

No discussion of Controllers would be complete without an explanation of the similarities and differences of these two control change messages. They are both channel messages, which means they apply to programs on the MIDI channel they are sent. Volume is control change message 007 and Expression is control change message 011. They both affect the overall loudness of the sound but in a different manner. Volume (cc007) is sometimes called "main volume", although main *channel* volume would be more correct. It sets the level of the MIDI channel – let's say you set it at 96 on the scale of 0-127. This is as loud as that track will get compared to the adjacent tracks. Expression (cc011) can now be used to adjust the level of that track from 96 down to 0. So a foot controller assigned to cc011 on this channel will be 96 at the "toe down" maximum position and 0 at "heel down" minimum position. You have set a maximum volume with controller 007 and you set a performing volume with the pedal assigned to controller 011. Without this anytime you attempted to use volume you might exceed the

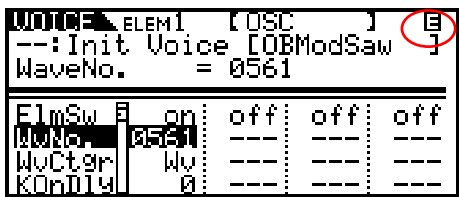96-level that you determined should be the maximum for this musical Part.

Another important use for the Expression versus Volume control is when you are using a Performance type Multi with several Parts layered on the same MIDI channel. If you attempt to adjust the volume with a pedal assigned to Volume (cc007) **all** the PARTS will jump to the absolute level of that pedal. This would be a bad thing if you were trying to preserve the delicate volume balance between a String layer (92) and a Piano layer (104). It would be better to control the loudness of this Performance MULTI with a pedal assigned to Expression (cc011) because this controller will maintain the proportion of the strings to the piano as it adjusts loudness up and down. The piano will always be proportionately louder than the strings. Volume cc007 is "absolute" and Expression cc011 is "relative".
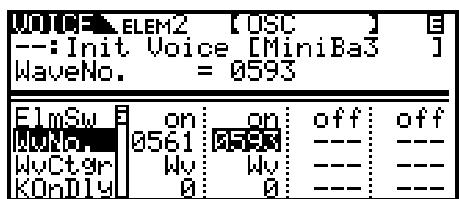
Advanced Applications

Let's put the knowledge of Control Sets to work in a real world application. In this example we deal with controlling VOLUME via controllers within a Motif-Rack ES sample-based Voice. This can be tricky, but this example should make it clear how it all 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**:
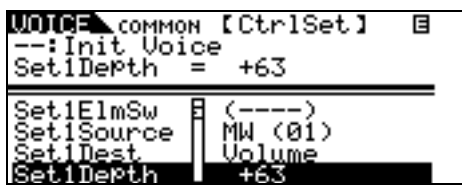
- Press [UTILITY]
- Page [>] to the "JobSel" Job Select screen.
- Initialize is at the top of the list.
- Press [ENTER]
- Select "Current 1 Voice" and then [ENTER] twice to execute. This will create an INIT VOICE with just a piano wave in it.
- Press [EDIT]
- Let's select a synth wave. Navigate to the OSCILLATOR WAVE page on the ELEMENT level: If the [MUTE/SEL] LED is lit, press it to turn it **OFF**. This will let you *select* ELEMENTS when you press the "[<] PART" button. (Notice the 'ELEM1', 'OSC' and inverse video 'E' on the top line – denoting the Voice has been edited but not yet stored and we are editing Element 1.)
- Cursor down to the 'WvNo.' parameter and select sample wave #0561 [OBModSaw]

```
VOICE ELEM1 [OSC    ]
--:Init Voice [OBModSaw ]
WaveNo.     = 0561

ElmSw  | on  | off | off | off
WvNo.  |0561 | --- | --- | ---
WvCtgr | Wv  | --- | --- | ---
KOnDly | 0   | --- | --- | ---
```

- Now, for fun, lets activate a second element in this Voice. Press the PART [2] button that represents Element 2. You can now turn the Element Switch (ElmSw) **ON**.
- Set Element 2 to waveform #0593 [MiniBa3]

```
VOICE ELEM2 [OSC    ]
--:Init Voice [MiniBa3 ]
WaveNo.     = 0593

ElmSw  | on  | on  | off | off
WvNo.  |0561 |0593 | --- | ---
WvCtgr | Wv  | Wv  | --- | ---
KOnDly | 0   | 0   | --- | ---
```

- You can use PART buttons [1], [2], [3], and [4] to **select** Elements ([MUTE/SEL] LED is OFF, and the [MUTE/SEL] (LED ON) to turn the sound **on/off**. Try it! Currently we can use [1] and [2] to select and then light the MUTE LED to activate and deactivate Elements [1] and [2] to temporarily mute and un-mute our two Element Voice. This will allow you to isolate each element when you want to concentrate on just one at a time. Practice this basic skill.
- Navigate to the CTL Set (Control Set) page. (Press [SHIFT] + [COMMON] to return to Common edit.
- PAGE [>] to the CTRL SET screen
- Set the CTL SET 1 as follows:

```
VOICE common [CtrlSet]  
--:Init Voice
Set1Depth  = +63

Set1ElmSw  | (----)
Set1Source | MW (01)
Set1Dest   | Volume
Set1Depth  | +63
```

In the above example, the Volume parameter is 'common' to **all Elements.** We know this because the Element Switches are grayed out (parenthesis). If you were to activate additional Elements they would also share the same setting when you select a 'common' destination. The modulation wheel will affect 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 we 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. In other words something else is controlling how loud this sound is as well and is overriding us – of course, it's the main Volume assignment that responds to note-on. Here is how to change it.

Navigate to the Common OUTPUT page by hitting PAGE [<] twice. Here you will see a parameter for the total volume of the Voice = 127. Program it to 0. That's right, 0.

```
VOICE common [Output ]  
--:Init Voice
Volume   =    0

Volume  | 0
Pan     | C
RevSend | 12
ChoSend | 0
```
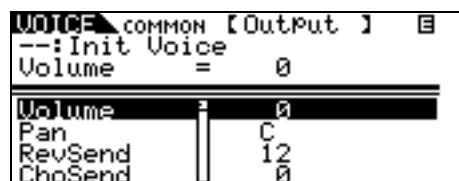
Now when you move the modulation wheel you have **total** control over the volume of the Voice. The position of the modulation wheel is now an *absolute* representation of the current common volume, 0-127. We call this process 'biasing' the parameter (in this case, volume) to the controller. In other words, it will now look to this controller (mod wheel) for volume instructions. Okay, return the Common Voice Volume to 127 before continuing. --END OF EXPERIMENT 1--

Similarly, a volume assignment can be made on the Element level. This would allow the player/programmer to have control over specific parts of the sound (Elements) within a Voice. In our Control Set instead of making the Destination = Volume (common overall volume) like before, this time assign it to **ELM-Lvl** or Element Level. 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.
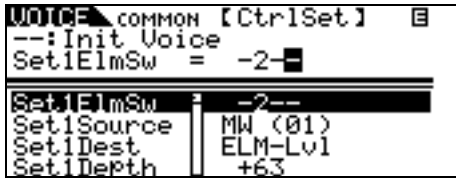
Here's how:
- Return to the Control Sets: press PAGE [>] twice.
- Select 'ELM-Lvl' as the 'Set1Dest' (destination). Set only Element 2's level to be controlled via the MW (Element Switch).

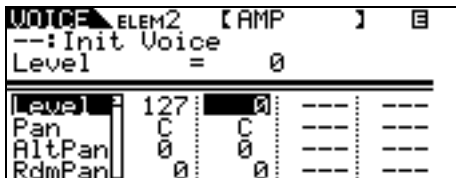This is accomplished by moving the cursor to the Element Switch line and setting it so it reads:
"-2—"

(Use the BANK [<]/[>] buttons to move between Elements and the Data Wheel to turn them ON and OFF).

```
VOICE COMMON [CtrlSet]    ▤
--:Init Voice
Set1ElmSw  =  -2-■

Set1ElmSw  ┃  -2--
Set1Source ┃  MW (01)
Set1Dest   ┃  ELM-Lvl
Set1Depth  ┃   +63
```
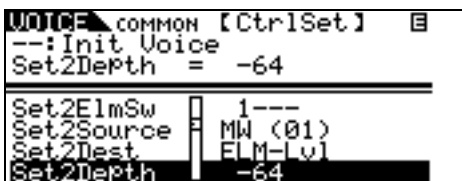
And in a similar fashion to before, you would need to set the initial level of the Element(s) that you are controlling to zero (bias its level to the MW). Instead of "Total Voice Volume" we are looking for the level of this particular Element. This is found on the Element Amplitude page: Return to Element Level editing by pressing PART [2] button (Element 2 Select).
Press PAGE [>] to select the 'Amp' screen.
Set the Level of Element 2 to 0.

```
VOICE ELEM2  [AMP    ]    ▤
--:Init Voice
Level      =    0

Level ┃ 127 ┃ 0 ┃ --- ┃ ---
Pan   ┃  C  ┃ C ┃ --- ┃ ---
AltPan┃  0  ┃ 0 ┃ --- ┃ ---
RdmPan┃  0  ┃ 0 ┃ --- ┃ ---
```

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 (found on the Control Set screen by scrolling down) 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 up it will fade out one sound and fade in the other.

```
VOICE COMMON [CtrlSet]    ▤
--:Init Voice
Set2Depth  =  -64

Set2ElmSw  ┃ 1---
Set2Source ┃ MW (01)
Set2Dest   ┃ ELM-Lvl
Set2Depth  ┃  -64
```

Notice you did not have to set the Element Level in this case to 0. This is because if you did and then applied a minus value to it…this would be illogical…levels below 0 are still inaudible. Experiment. What we have done in the case of Element 1 is apply a negative value to existing Volume as we move the wheel up. Think about it – it's a Zen thing.

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 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. To use a Breath Controller with the Motif-Rack ES you controller keyboard must have a BC input.

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. Each element can have a different filter type and cutoff/resonance. Each element that you add can have its own filter and filter settings.

Note 2: When using Breath Control on sampled-based Voices you may find it easier to just reassign the BC to Expression (cc011). Here's how: from Voice mode press [UTILITY]/ PAGE to the VOICE screen/ Cursor down and set 'BC Assign' = 11[Expression]. This will allow you to immediately control any internal sound with BC - without any further programming.

Note 3: There is no BC input on the Motif-Rack ES, so in order to use the Yamaha BC3 with the unit your controller must have a BC input.

After any and all Voice edit procedures you should STORE your data (if it is worthy of keeping). If you started editing a Preset or you started editing an USER Voice, simply point the Store procedure towards a desirable USER location.
- Press [ENTER] + [STORE]
- USING the cursor arrows [<]/[>]/Up/Down to select a location in USER 1, USER 2 or USER 3 and then press [ENTER] twice to execute.

Control Sets Summary: Each AWM2 (sample-based) Motif-Rack ES Voice has six Control Setups where a physical controller, called the Source, 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 or Depth 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 43 of the Data List booklet that comes with your Motif-Rack ES. They include Voice volume, reverb send, chorus send, and some 32 Insertion Effect parameters (not all Insertion Effect parameters are real time controllable). And if you are dealing with the internal sample-based 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, PLG2 and PLG3 Voices will be able to be assigned to volume, reverb send, chorus send and the 32 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.

Control Sets: PLG150-series Plug-in Voices
PLG150 boards will have a different set of Controller Set parameters (explained in detail below). Also, look in the Voice Editors for each PLUG-IN board for additional assignable controller routings. For example, the PLG150-AN has some 8 AC (assignable control devices) and 15 Control Sets available. The PLG150-AN is based on the AN1x keyboard synth, which had 8 front panel assignable knobs AC1-AC8. 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.

PLG150 Series boards are *single* PART boards and have two kinds of Voices: PLUG-IN and BOARD. PLUG-IN Voices are those that have been integrated with Motif-Rack ES Effects and Controller routings (discussed below). BOARD Voices are resident on the Board itself and have not yet been integrated with the host parameters (hopefully you will customize them to your liking). Each board comes with a different amount of Board Voices for you to build PLUG-IN Voices and the Motif gives you 64 blank USER locations for you to place them.

Plug-in Voices will have two Control Sets that allow you to route real time control to Volume, Reverb Send, Chorus Send and the real time controllable Insertion Effect parameters. The PLG150 Voices will have the following additional Controller (CTL) screens that will let you route controllers to the following areas in addition to two Control Set setups:

PLG Modulation Wheel Assignment: In each Motif-Rack ES PLG150 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 the direct control of Pitch with (AT) key pressure, Filter, Pitch Mod, Filter Mod, and Amplitude Mod (not shown).

Assignable Controller: For each PLG150 Voice you will find a screen for an Assignable Control – 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.

Depending on the PLG board you may have access, via the Motif-Rack ES front panel, to selecting a specific parameter to control with the AC selected here. Look in the PLG boards UTILITY "PLGxSYS parameter area (where 'x' is your slot 1 or 2).

Understanding how the Controller and the Parameter ranges work:
Put on your thinking caps…this is tricky. Remember I mentioned logic – well here we go. 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 Controllers (sweep pedals)
Breath Controller
Aftertouch
Control Sliders (without center détente)
Knobs (without center détente)
Foot Switch / Sus * *(min. **or** max. only)

Negative ~ 0 ~ Positive Controllers
Pitch Bend Wheel
Knobs (with center détente)
Control Sliders (center détente)
Spring-loaded levers
Ribbon Controllers

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 an Assignable (Knob) that is normal at 12 o'clock… here's what happens:
-The 12 o'clock position or center 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 volumes less than 0 (if you do, please consult a doctor for help).
-It is **not** an issue when you assign a negative/positive parameter, like pan position, to a negative/positive controller like a Knob with a center position. In such a case, counterclockwise pans left, clockwise pans right and 12 o'clock is center. It is logical.
-If you assigned panning to Breath Control (which is minimum to maximum), for example, 0 would be left and 127 would be panned to the right. You are not talented enough to find center easily. The harder you blow the further to the right you pan.

Conclusion: Consider the above when selecting a controller for a specific parameter.

Phil Clendeninn
Senior Product Specialist
Technology Products
©Yamaha Corporation of America