

# WATER

By Brian Cowell

## Adventures in FDSP

A tutorial for Yamaha EX series Synthesizers

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mind + music + technology

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## **1. Introduction**

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The WATER function is an interesting way to further process your sounds. By default, the setting is a reasonably fast "liquid" type of sound that plays over your texture. It tends to more of a sound effect in this state. However, it can be a lot more than that.

Through this document, we will explore this function in a little more depth and explain some of the key functions a little better. Firstly, I would like to pass on a warning.

## **2. WARNING:**

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It surprises me that YAMAHA did not warn people about this function, but I will spell it out to you. The WATER function can produce some highly resonant peaks, which can damage your speakers. A lot of care needs to be taken when programming with this function. I recommend that you bring the volume slider down at least to half way if you are going to experiment with this function. Some sounds can give the impression that they are way under in volume, then all of a sudden produce, an earth shattering resonant peak. This can happen with very low **resonance** settings. You have been warned.

## **3. The components of WATER:**

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The main component used for the "running water" effect is the S&H (Sample and Hold) LFO. A LOWPASS filter then processes it. Then the input signal (your voice ELEMENT) and the result from the LOWPASS filter are then processed through a BANDPASS filter. A certain amount of the input signal can be let through at a stage that is unprocessed and will appear as "dry". From the BANDPASS, the signal is then sent through another LOWPASS filter, and through a "pitching & delay" function. A certain amount is feedback into the system. (This is the source of the high resonant peaks).

The signal is then taken through an "envelope generator" (EG) and then processed through a final HIGHPASS filter. The resultant signal is then mixed with whatever amount is appearing at the "dry" output.

YAMAHA say this algorithm is part of their "Virtual Analog Synthesis" engine.

By breaking these components down one at a time, we will see how these components interact with each other. From there, we will see that sounds other than "running water" are possible.

These sounds will still have a "liquid" texture or a "bird chirping sound, but will be part of the sound rather than being applied "on top" of an input sound.

Lets look at how it looks in its "default" state.

#### **4. The "default" setting:**

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When the "water" FDSP function has been selected for use in a VOICE, the following settings are what the EX-series will initially start with.

Pitch Coarse	=	+0
Pitch Fine	=	+0
Key Follow	=	32
Freq	=	64
Freq K.Flw	=	+15
Resonance	=	63
Freq Mod	=	63
Mod Speed	=	200
Mod Smooth	=	0
Feedback	=	59
Feedback Kf	=	+5
High Dump	=	5
High Dump KF	=	+4
Release Time	=	48
HPF	=	47
Wet Level	=	+51
Dry Level	=	+12
Pan	=	Cnt

**Dry Level:** This is where you can set "how much" of the original signal will bypass the WATER function. Turn it up enough, and you will drown out the **wet level** completely.

**Wet Level:** This is the amount of the WATER effect that is output into the mix. You can actually just have this part turned up and have the **dry level** set at "+0". This allows for just have the S/H LFO effect on the sound.

**Mod Speed:** This controls the speed of the S/H LFO effect. It is also the main contributing culprit in producing the "high resonant peaks". This is because, that when the LFO is fast, the "resonant peaks" **don't** have time to evolve. However, it's the slow settings in this parameter that causes many other interesting effects. Just be aware of what it can do.

**Mod Smooth:** The S/H LFO in its true form, is a rising and falling (at random) square wave when set to "0". Some nasty artifacts like clicks (this maybe what you want) is caused by having it set to "0". This is caused by the straight edges on the square waves. The idea with this parameter is that you are able to "cut" some of these edges and make

them rounder. Set high enough, and the S/H LFO will sound smooth and evolving. Set to high, and the S/H LFO is blurred altogether.

**Freq:** Is the actual filter "cutoff" used on the S/H LFO when it passes through the BANDPASS filter. (Check the EX Manual: page 128. Look at the diagram where it says "Cutoff"). This parameter is directly affected by the setting in **Freq K.flw** and **Freq Mod**. The idea behind **Freq** is that it is allowing you some form of filtering of the LFO effect itself.

**Freq K.Flw:** This allows the keyboard to move the **Freq**, in step with the keyboard. A negative setting tracks the keyboard lower (meaning the LFO effect will follow it down), while a positive setting will see it track the keyboard higher. The Ex5 manual is incorrect with its description of this parameter. This parameter is also affected by **Freq Mod**.

**Freq Mod:** This is one of the most crucial parameters in the WATER function. It controls how much depth (or effect) the LFO will have on the **Freq** parameter. Turn it down to "0", and the BANDPASS filter will be just filtering the input signal with whatever the **Freq** parameter is set at. There will be no "chopping" of the filter with the S/H LFO at all. In essence, it is the heart of the WATER function.

**Feedback:** Sets the strength and amount of the resonating sound will be pumped back into the processed signal. This parameter can cause "high resonating peaks" if the **Mod Speed** parameter is set to a slow speed. (Be careful !). It is relying on what both the **Resonance** and **Pitch Coarse** parameter are set at. If the two of these are set to "0", then there will be practically no feedback into the processed signal whatsoever.

**Feedback Kf:** This sets the amount that the actual **Feedback** will track the keyboard.

**Resonance:** The **Freq** parameter uses this setting for resonance in the BANDPASS filter. When set really low, a lot of the input signal will appear being "chopped" up. Set higher and it distorts the signal to the point where the input signal is lost and only the WATER effect remains.

**ReleaseTime:** This is the envelope generator for the WATER function. Using some settings like **Pitch Coarse** will introduce "long tails" onto the sounds through an echo effect. Setting **Release Time** to a low setting will shorten the release after you have let go of a key. Higher

settings will let **Pitch Coarse** do what it wants. If your not sure, think of it as the AEG (Amplitude Envelope Generator) of WATER.

**High Dump:** This is the filter that is used to allow how much of the BANDPASS's higher frequencies are actually passed onto the **HPF** filter and the amount fed into the **Pitch Coarse** parameter. A low setting makes the sound extremely dull, while higher settings leave the sound brighter.

**High Dump Kf:** This tracks the **High Dump** filter across the keyboard.

**HPF:** This is the final stage of the WATER process. (Apart from setting the **Wet level**.) It cuts the lower range of the sound. The fact that the High Dump and HPF are in series, they are forming a bandpass type filter for the last stage of the WATER process, but with a lot more control.

**Pitch Coarse:** This parameter is quite deceptive. It can actually do a lot more than what its description mentions. It not only affects the PITCH of the sound, it also attributes a "delay" effect on the sound. A negative setting will produce long "multi-tap" delays. Too much of a negative setting and the sound will continue tapping for a long time. The **ReleaseTime** can control the length. The idea behind it is that you will have some sort of setting in **Pitch Coarse**, and the **Feedback** parameter will re-introduce the new signal into the processed signal. So they are usually used in conjunction with each other.

**Pitch Fine:** This parameter allows for finer tuning then the **Pitch Coarse** parameter.

**Keyfollow:** This sets the tracking of the **Pitch Coarse** and **Pitch Fine** parameters on the keyboard. A setting of "+32" allows these other two functions to track the keyboard 100% in relation to the pitch played on the keyboard. In other words, it helps it to move in unison with the pitch. A setting of "-32" makes it a reversal, where the pitch in the upper range start sounding more deeply resonant. It allows for a good deal of experimentation as it changes the way both **Pitch Coarse** and **Pitch Fine** are applied to the keyboard.

**Pan:** This sets the panning of the sound of both **wet** and **dry levels**. Adjusting this will adjust them in tandem. What can "blur" the panning settings is the use of either one of the GLOBAL or INSERT effects. I.e. Auto-pan.

## 5. Using Water:

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The first thing I like to do when I've selected WATER as the FDSP function is to set all the parameters within it to "0". You can do this with all the parameters except for **Mod Smooth** (which has a minimum value of 2) and **Pan**.

I then proceed to program the parameters in this order:

Set **Dry level** to "0".  
Set **Wet level** to "63".  
Set **Freq** to "90". You will notice that the volume level is low.  
Set **High Dump** to "7".  
Set **Feedback** to "24".  
Set **Mod Speed** to "70".  
Set **Freq Mod** to "44".  
Set **Keyfollow** to "+32". You will notice the volume level is higher.  
Set **Resonance** to "39".  
Set **Mod Smooth** to "29".  
Set **HPF** to "8".

This is my starting point. You may like to develop along these lines or create a starting point of your own. The thing to remember here is that none of the original signal is present here, because the Dry level is set to "0".

## **6. Points to remember:**

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The things to keep in your mind when programming the WATER function is that all the changes are not immediately obvious. Sometimes tweaking a parameter will result in something audible if you are sustaining a note on the keyboard. With some parameters, this is not the case. I recommend that if you are changing parameters that you continually press down notes to hear your changes.

Another thing to remember is to not go and program any Elements in a VOICE unless you have selected FDSP in the "Common" page first. Otherwise, all your programming will be lost. You must decide at the very start if you are going to program a FDSP sound before you do anything else.

Problems can arise also when you all of a sudden change the wave you are using. This has repercussions on both volume levels and the amount of resonating peaks that may present themselves to both you and your speakers. Again, you have been warned!

The best way to understand how WATER works is to do some examples.

## **Example No.1: Liquid Realms**

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Dial up a blank VOICE and press **[EDIT]**. Turn the volume down to at least half way.

Press **[COM]** and change the "Type" to 03. Now change "ElmSw" to ON. You have now turned on the FDSP and the WATER effect.

Press **[OSC]**.

Change the sound to "0059 Or: D4 ".

Now go back to the FDSP page by pressing **[COM]**.

Make the WATER function as follows:

Pitch Coarse	=	+0
Pitch Fine	=	+0
Key Follow	=	32
Freq	=	64
Freq K.Flw	=	+15
Resonance	=	5
Freq Mod	=	63
Mod Speed	=	8
Mod Smooth	=	55
Feedback	=	15
Feedback Kf	=	+5
High Dump	=	5
High Dump KF	=	+2
Release Time	=	48
HPF	=	47
Wet Level	=	+63
Dry Level	=	+0
Pan	=	Cnt

Press **[EFCT]**.

Change the "InsEF" from "off" to "1".

Make the effect path as "EF1->EF2".

Change Insert Effect 1 to "Compressor", and change Insert Effect 2 to "Echo".

Now play the keyboard.

You will notice that there are some nice tones in this program. The sound is a long way from perfect, but it gives you an idea of how this sound can be manipulated into something ethereal.

If you like this sound, press the **[STORE]** button.

## **Example No.2: Fantasy World**

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This sound makes use of the Pitch Coarse parameter, which uses a heavy negative setting. It also uses an extreme resonance setting. The sound in particular is more a sound effect but totally applicable to a "new age" type of sound.

Dial up a blank VOICE and press **[EDIT]**. Turn the volume down to at least half way.

Press **[COM]** and change the "Type" to 03. Now change "ElmSw" to ON. You have now turned on the FDSP and the WATER effect.

Press **[OSC]**

Change the sound to "0012 Pf Rho1P- "

Now go back to the FDSP page by pressing **[COM]**.  
Make the WATER function as follows:

Pitch Coarse	=	-64
Pitch Fine	=	+0
Key Follow	=	+0
Freq	=	79
Freq K.Flw	=	+15
Resonance	=	63
Freq Mod	=	63
Mod Speed	=	9
Mod Smooth	=	45
Feedback	=	54
Feedback Kf	=	+5
High Dump	=	10
High Dump KF	=	+4
Release Time	=	48
HPF	=	73
Wet Level	=	+63
Dry Level	=	+2
Pan	=	cnt

The only other thing I have done with this sound is gone into the **[SCF]** filter page and set the "Type= boost 12dB ".

To play this cool "new age" sound, you press a chord and hold it for a long period of time. You will hear the sound take on different textures and come alive.

### **Example No.3: The Birds**

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This is the sound of chirping birds in a garden. The important factor to it is the **Mod Smooth** parameter. Its turned up enough so that sound is blurred.

Dial up a blank VOICE and press **[EDIT]**. Turn the volume down to at least half way.

Press **[COM]** and change the "Type" to 03. Now change "ElmSw" to ON. You have now turned on the FDSP and the WATER effect.

Make the WATER function as follows:

Pitch Coarse	=	-64
Pitch Fine	=	+0
Key Follow	=	+0
Freq	=	88
Freq K.Flw	=	+0
Resonance	=	63
Freq Mod	=	63
Mod Speed	=	40
Mod Smooth	=	50
Feedback	=	0
Feedback Kf	=	+5
High Dump	=	0
High Dump KF	=	+0
Release Time	=	48
HPF	=	42
Wet Level	=	+63
Dry Level	=	+0
Pan	=	cnt



<http://www.soundengine.com>

**Check out Brian Cowell's CD-ROM's in WAV format at  
SoUnDEnGiNe.**

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