

After 13 Years....

Sabine Feedback Control is Still the Best Choice

Thirteen years after inventing the world's first successful automatic feedback control device, Sabine, with its patented system, retains its technological lead.

Since microphones and amplified loudspeakers were first paired, acoustic feedback has lain in ambush, ready to sabotage sound systems, ear drums, listener enjoyment, and sound engineer egos with equal malice. Until Sabine came along, the various cures and preventative measures for feedback elimination were problematic, expensive, complicated, fraught with compromises in sound quality, and/or just plain didn't work.

The ravages of runaway feedback continued unabated until 1990, when Sabine's breakthrough brought the world its first practical automatic feedback controller: the FBX Feedback Exterminator. In the years since, Sabine's products have proven to be easy to operate, reliable, and unrelentingly effective in providing 6-9 dB increases in feedback-free sound system gain with no audible effect on sound quality.

Our proprietary technology makes that claim even truer today than it was 13 years ago. Continuous advances and improvements mean that Sabine's family of products delivers the purest audio and finest protection from all varieties and levels of feedback.

Of course, success breeds imitation, and Sabine's leadership has led other manufacturers to develop and market competing feedback control products, with a variety of features and prices. Nonetheless, with our pioneering technology and ongoing improvement, Sabine maintains its industry leadership.

Our patented technology puts us in this position of leadership. And, as leaders, we feel it is our duty to remove the veil of mystery surrounding the art and science of automatic feedback control. In doing so, we must first ask a simple question....

What makes a good feedback controller? After years of studying the science of feedback elimination, we've reduced the key characteristics of a quality feedback control device to three essential areas: filter **accuracy**, **speed**, and **resolution**; sound **integrity**; and system **adaptability**.

Accuracy. Of these ingredients, a filter's quality is the most multifaceted, and thus requires the most detailed exposition. We define filter accuracy as *setting the right filter to eliminate or prevent feedback*. This deceptively simple rule refers not only to the creation of

a filter necessary for feedback control, but to the degree of restraint quality feedback controllers exhibit in setting false (i.e., *unnecessary*) filters.

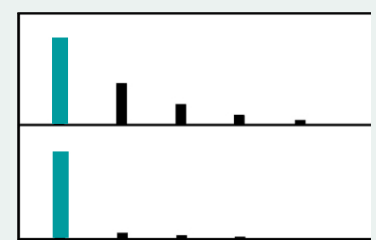
At the core of the accuracy criterion is the proper identification of feedback when it occurs. In simple cases — for example, when deliberately provoking feedback during the setup of a sound system — identifying feedback is quite simple. In such conditions, when the only sound output is intentional feedback, it's not

rocket science for a feedback controller to correctly detect its presence (though, of course, effectively curing the problem *does* require sophisticated technology).

Unfortunately, feedback doesn't go away after setup. As room conditions (audience size, temperature, humidity, gain requirements, etc.) change, as people of all skill levels operate the sound equipment, and as the system is pushed to its limits, feedback can appear at any moment. When both feedback and program audio occur simultaneously and thus must be distinguished, the true quality of automatic feedback controllers becomes far more important — and far more evident.

The success with which the patented Sabine algorithm distinguishes feedback from audio program is the key to our products' superior performance. The human ear can readily distinguish not only feedback from audio, but also one instrument from another, or one human voice from many possible sources. Our primary auditory clue for making such judgments is the series of **h a r m o n i c** overtones that are

unique for each instrument and voice. String instrument players are familiar with harmonics, created by partially muting a string (at the 12th fret of a guitar, as a prime example) as it's plucked. This effectively mutes the fundamental tone of the string, and lets a softer, higher pitched tone be heard more clearly. That harmonic, and a series of others, contribute to the rich sound our ears immediately identify as "guitar."



Harmonics: The top chart shows a fundamental musical tone and its harmonics. The bottom chart shows a feedback tone. Note there is almost no harmonic content.

Feedback has a unique overtone signature — essentially, it has almost no harmonic content, in striking contrast to the resonant, rich tones produced by the human voice and intentionally designed into musical instruments. Thus, one — in fact, we would argue, the best — method for distinguishing feedback from good audio is to analyze the comparative level of harmonic content in any sound. If it's low enough, the odds are very high that the sound is feedback.

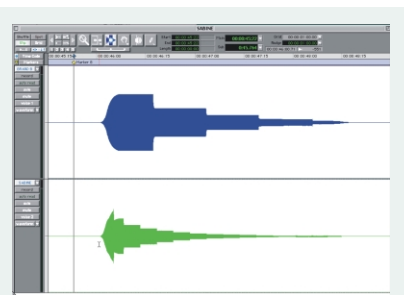
This type of analysis, of course, is precisely the sort of fast, intensive number-crunching that digital signal processors excel at. And this analysis is at the core of Sabine's patented, proprietary method of accurately identifying feedback.

Competing feedback products have thus had to devise other, more problematic methods of identifying feedback, such as analyzing numerous frequency bands for sudden changes in gain (in consideration of the fast onset of feedback). Of course, one of the most inspiring aspects of music is its dynamic character — in other words, sudden changes in gain. Thus, this method of identifying feedback is far more prone to errors, and can easily mistake normal audio dynamics as feedback, and set filters inappropriately.

Sabine's patented algorithm is the best method of distinguishing feedback from audio, and results in a far more accurate set of filters. You'll get the ones you need to control feedback, and a minimum of false filters. You can test how readily feedback controllers place false filters by simply feeding an audio program (your favorite CD, for example) into the unit's inputs and watching for filter placement.

Speed. Most people are familiar with Einstein's theory of relativity, which states that time duration and pleasure work in opposite directions (OK, it wasn't

Einstein, but it's true nonetheless). Each minute spent in a dentist chair lasts far longer than an "equal" interval engaged in pleasurable activities. For this reason, Sabine products are designed to minimize the unpleasurable duration of amplified

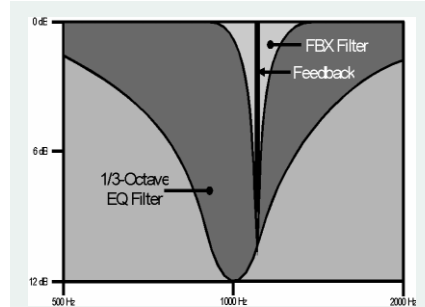


Speed of feedback elimination: The top chart shows the speed of a competitor. Note slow reaction time and longer time to eliminate the feedback. The bottom section shows the much faster FBX.

feedback. Our algorithm is designed to respond in a fraction of a second, eliminating feedback almost as soon as it occurs.

Turbo mode is a unique Sabine invention that helps sound engineers "ring out" an audio system during setup with an absolute minimum of feedback, keeping it both very low in volume and very brief in duration. This reduction in loudness and increased feedback capture rate not only prevents those strange, annoyed looks that deliberately provoking feedback elicits, but it also helps protect speakers and eardrums from painful and persistent shrieking. Setup is amazingly fast and quiet — no need to clear the room!

Resolution. When faced with the task of "equalizing" a sound system most sound engineers choose tools that maximize control over all parameters of the available filters. Parametric filters provide control over filter width, depth, and placement, and a good automatic feedback controller is essentially an automatic



A direct hit on feedback: FBX filters are placed exactly on the feedback tone. Other filters, like those of graphic EQs, can only come close. Note gray area indicating the sound lost by using wider, less accurate filters.

version of a parametric filter set, with each parameter crucially controlled by the "brains" of the unit.

Filter placement, or resolution, is the first step to surgical control of feedback. The closer the filter can be placed on the offending tone, the more effective it will be in eliminating it. The FBX makes a direct hit on each feedback tone. Not "in the neighborhood," or "close enough," but placed with absolute precision right on the offending feedback frequency with 1 Hz resolution.

In addition, the FBX will maintain that resolution should the feedback tone drift with temperature or humidity. FBX filters track that movement within a given window, which is adjustable on the Q-Series. No other feedback controller offers this level of resolution.

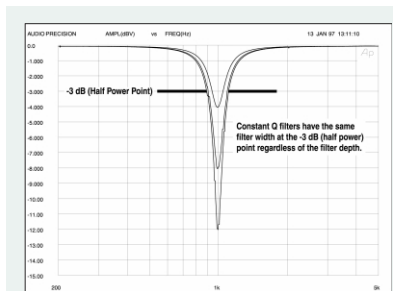
Sonic Integrity. Of course, setting filters only when necessary maintains the integrity of the signal passing through a feedback controller, by keeping the number of filters deployed to an absolute minimum. But what happens when a feedback controller does place a filter properly (a rarity in some cases)? How does this affect the purity of the audio signal?

Two primary filter characteristics — depth and width — dramatically affect audio quality. Sabine controls depth by placing filters only as deep as necessary to prevent feedback at the current operating level of the

sound system, and stands by to go deeper only when necessary. Users may also program the maximum depth allowed, or lock filters once they're set to prevent them from going deeper.

Width is a more complicated issue, though not overly so. Suffice it to say that a feedback filter should be wide enough to remove the feedback by attenuating a narrow band, but not so wide as to dramatically affect the audio quality. Notching offending frequencies by pulling down sliders on a graphic equalizer removes feedback, but cuts a huge swath of audio quality out as well — the proverbial throwing out of the baby with the bath water. Sabine's filters are typically set to about 1/10 the width of a graphic equalizer filter.

When Sabine was first developing FBX technology, a great deal of research was dedicated to determining



Filter quality: True constant Q filters maintain width at any depth when measured at the -3 dB power point. Competitors may not use industry standards to describe their filters

the optimal filter width. There is obviously a trade off between filter width and guaranteed feedback-free operation. A huge filter (for example, a gain control, which filters the entire audible bandwidth) will never allow feedback. After hundreds of hours

of testing and listening, we settled on a 1/10-octave filter width for critical musical applications, and 1/5-octave for less demanding speech amplification.

Too wide a filter of course degrades audio quality unnecessarily, of course, but what's wrong with too narrow a filter? As we mentioned earlier, a major concern arises because feedback frequencies are not completely stable, and can vary slightly as a function of changing ambient conditions such as temperature and humidity. Extremely narrow filter settings will result in clusters of filters in a very small area, and the phasing of poorly designed digital filters will begin to sound very strange in that area.

Some competitors tout the ability to set very narrow filters — less than a tenth-octave. If that's what you need, fine — you can adjust Sabine's Q-series filter width down to as low as one hundredth octave, narrower than any filter by any competitor. And the superior design of Sabine's constant Q digital filters prevents any phase problems. But, frankly, our tests with golden-eared sound engineers show an insignificant difference in the audio quality of a tenth-octave filter or a hundredth octave width

— both are very targeted and very transparent. Why set up a potential problem when there's no good reason to make a filter narrower than it needs to be?

Sabine's filter settings offer transparent feedback filters with the ideal balance of width and protection against feedback under shifting conditions. In addition, Sabine products offer maximum user control over a wide range of filter settings.

Adaptability. Every audio environment presents a new set of challenges, and engineers experience a great deal of angst in choosing the right gear for each venue and for each performer. These days an audio device that can be adapted for many uses generally gets the nod. Your feedback controller should possess the same versatility.

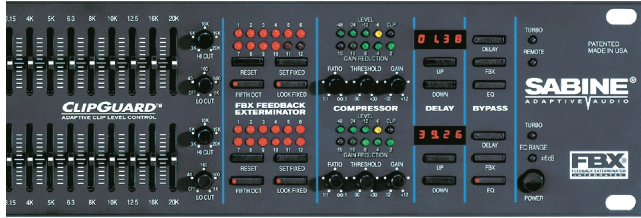
Years of research reveal that varying program types call for different optimal settings in a feedback controller. Specifically the ability to accurately distinguish between program and feedback can be extra difficult when the program includes long drawn out notes from instruments capable of producing tones with low harmonic content, such as organs and flutes. Sabine allows for this need for adaptability by providing a powerful adjustment to the FBX algorithm to suit each application.

For speech or a rock venues, you can speed up the algorithm and reduce sensitivity to harmonics for a lighting-fast response to feedback. In a church or classical venue, where pure musical tones might fool other feedback controllers, simply slow down the FBX algorithm and increase the sensitivity to harmonics, greatly reducing the possibility of false filters.

Often the need for versatility calls for the ability to place the feedback controller in the right place in the audio chain. Long an advocate of "Targeted Input Processing™", Sabine provides an array of feedback controllers that allow you to focus the control on the desired microphones, leaving other mics or program material alone. The many faces of FBX allow you to choose the right unit for the application. Choose from the SOLOs for single mic patching, the 1020/2020Plus for group inserts or post-mixer, the Graphi-Qs for both ways with hands-on or hands-off system processing, or the Power-Q for the ultimate combination of DSP functions. Or choose True Mobility Wireless Microphones. Each unit comes with the real FBX Feedback Exterminator built-in.

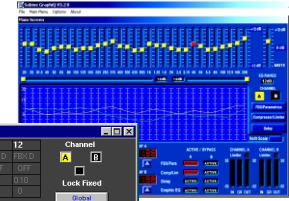
Conclusion: Seekers of feedback-free sound now have choices for automatic feedback controller. As the angst builds during the selection process, the preceding definition of a feedback controller will help winnow the wheat from the chafe. Luckily, for you the Sabine FBX Feedback Exterminator provides the best sounding, easiest to use, and most adaptable solution you will find anywhere.

Sabine FBX® Product Line Up – an FBX for every application



Graphi-Q Multi-Function Digital Signal Processor

FBX Feedback Exterminator®
Turbo Setup Mode
12 Filters per channel
FBX Filter Width: 1/100 to 1 octave
FBX Filter Depth: -6 to -80 dB
Switchable to Parametric Filters



Power-Q Multi-Function Digital Signal Processor

FBX Feedback Exterminator®
Turbo Setup Mode
12 FBX Filters per channel
FBX Filter Depth: -6 to -80 dB
Switchable to Parametric Filters
FBX Filter Width: 1/100 to 1 octave

#	Type	Frequency	Width	Depth	MODE
1	PARAM	250	0.20	+01	MAN
2	FBX F	458	0.10	-03	LIST
3	FBX F	837	0.10	-06	TURB
4	FBX F	958	0.10	+01	TURB
5	PARAM	1242	0.10	+01	MAN
6	FBX F	1500	0.10	-04	CH A

RESET FILTERS OPTIONS	
FBX Filters in A	EQ Filters in B
PARAM Filters in A	PARAM Filters in B
EQ Filters in A	EQ Filters in B
ALL OF THE ABOVE (HIGHEST PRIORITY)	



FBX2020-P & FBX1020-P

FBX Feedback Exterminator®
Turbo Setup Mode
12 Filters per channel
Filter Width: 1/10 or 1/5 octave
Filter Depth: Automatic -6 to -40 dB

FBX SOLO SL820 & SM820

FBX Feedback Exterminator®
Turbo Setup Mode
8 Filters per channel
Filter Width: 1/10 or 1/5 octave
Filter Depth: Variable to -40 dB



True Mobility® Wireless Systems

**SWM7000 2.4 Ghz
FBX Feedback Exterminator®**
Turbo Setup Mode
10 Filters per channel
Width: 1/100 to 1 full octave
Depth: 0 to -40 dB
Switchable to Parametric Filters



**SWM1600 (VHF) & SWM3000 (UHF)
FBX Feedback Exterminator®**
Turbo Setup Mode
10 Filters per channel
Width: 1/10 or 1/5 octave
Depth: 0 to -40 dB



Sabine FBX Users

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| United Nations Headquarters | Baltimore Ravens Stadium |
| Korean Broadcast System | Northwestern College |
| Walt Disney Company | United Artists Theaters |
| Fordham University | Navy Sea Lift Vessels |
| New Orleans Jazz Festival | NBC Studios Los Angeles |
| Hewlett Packard | Grand Mosque, Oman |
| Paul McCartney | Citrus Bowl |
| The Vatican | kd lang |
| Georgia World Congress Center | Australian Federal Parliament |
| BP Amoco Ltd., UK | American Stock Exchange |
| 18th Judicial Circuit Court | Museum of Flight, Seattle |
| York Minster Cathedral, UK | Smithsonian Institution |
| Agrodome, Rotorua, NZ | Cairo Opera House |
| Quantum Research International | Shea Stadium |
| Ripley's Aquarium | Amoco Corporation |
| Ozzy Osbourne | Hewlett Packard |
| PACE Sound & Light, Inc. | CBS Studios |
| Torwar Arena, Warsaw, Poland | Grand 'Ole Opry |
| Hyatt Regency San Francisco | Wendy's Restaurants |
| Strategic Missile Defence Command (SMDC) | Rock'n'Road Audio |

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