

OPERATING GUIDE

FBX[®]1200 FEEDBACK EXTERMINATOR

FBX[®]2400 DUAL FEEDBACK EXTERMINATOR

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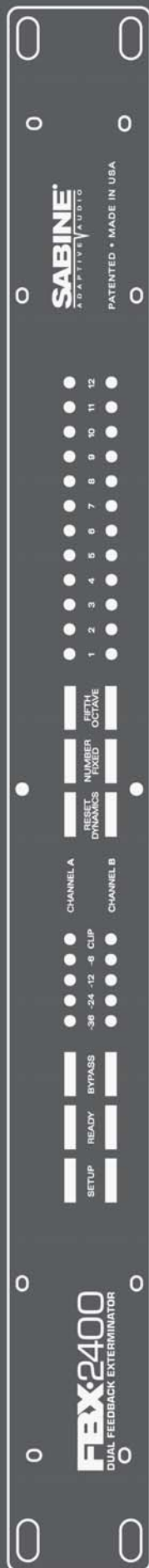
SMARTFILTERS

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Quick Start Setup on back page

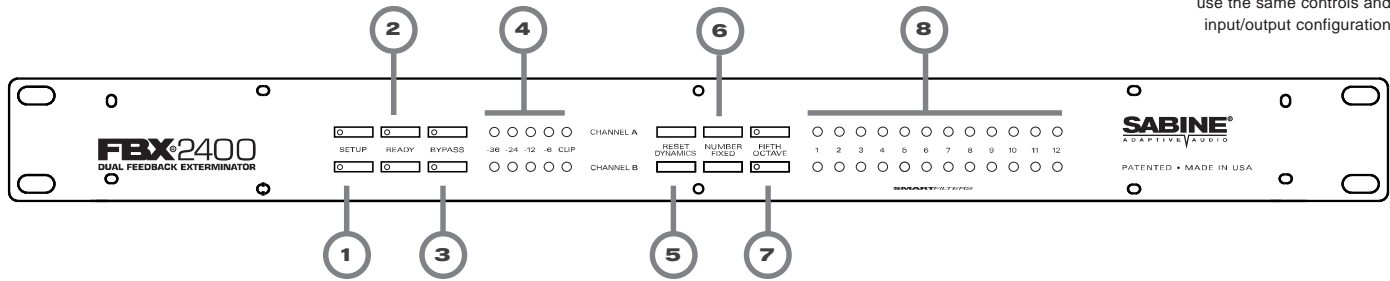
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SECTION ONE — FRONT & BACK PANELS

1.1. FBX2400 Front Panel Controls & LED Indicators

Note: FBX1200 front and back panels use the same controls and input/output configuration



1. SETUP

Press and hold this button to begin the FBX setup mode. Filter LEDs (light emitting diodes) will flash 5 times and the SETUP LED will begin to flash. You are now ready to set FBX filters.

2. READY

The READY LED lights when the automatic FBX setup process has completed, or the READY button has been pressed. This indicates your unit is ready for operation. The total number of filters available for feedback filtering is 12; in the factory default setting, your unit will automatically enter READY mode when the tenth filter is set. Alternatively, you may enter READY status with fewer Fixed FBX filters in place, simply by pressing the READY button at any time. Press READY again to lock the Fixed filters.

3. BYPASS

Bypass mode takes the unit out of the signal path so that it will have no effect on the program. In active mode, the unit controls feedback automatically. The red BYPASS LED lights when the unit is in bypass mode.

4. SIGNAL LEVEL

The LED ladder indicates the signal strength relative to the FBX's input clip level.

5. RESET DYNAMICS & DYNAMIC FILTER TIMER

Press and hold this button until the Dynamic filter flash and LEDs go off to reset all Dynamic filters. See **Section 5.2.4** for enabling and setting the Dynamic Filter Timer.

6. NUMBER FIXED

Set the number of available fixed filters by pressing the NUMBER FIXED button (6) until the LEDs stop flashing, then release it. The LEDs (8) will begin to light in sequence. When the LED corresponding to the desired number of fixed filters lights, press the Number Fixed button to register your selection.

7. FIFTH OCTAVE

Press the button at any time to select wider filters for any new filters to be set. It is possible to have both 1/5 and 1/10 octave constant "Q" filters active in one channel simultaneously.

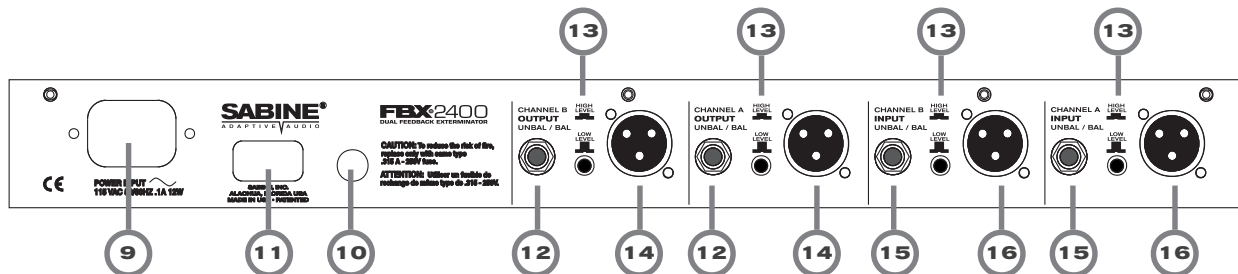
8. FILTER STAGE ACTIVITY

When one of the unit's filters is activated, the corresponding LED lights. A blinking LED indicates the filter that was most recently activated.

FILTER COLOR KEY

RED	= FBX Fixed, Locked
AMBER	= FBX Fixed, Unlocked
GREEN	= FBX Dynamic

1.2. FBX2400 Back Panel Controls & Connections



9. A/C Power Input

The FBX1200 & FBX2400 Series is factory configured to operate at either 115 VAC or 230 VAC. Using the wrong input voltage may cause permanent damage to the unit and will void the warranty.

10. Fuse

This equipment is fitted with an IEC power inlet incorporating a built-in fuse holder. To change the fuses in this socket:

1. Disconnect the power cord from the unit.
2. Pull out the fuse holder and remove the old fuse.
3. Install a new fuse into the holder. Replace only with one of the following fuses:
 - 115 VAC: 0.1 A, 10 W, 0.160 A SB fuse
 - 230 VAC: 0.06A, 10 W, 0.080 A T fuse
4. Refit the fuse cover.

11. Power Switch

Previous settings retained during power-off.

12. Quarter-inch Output

TRS balanced or TS Unbalanced output (using a TS unbalanced connector will result in loss of 6 dB gain). **Important: Refer to section 5.2.**

13. Input/Output Level Switches

Set to match your desired Input/Output level configurations. **For unity gain set both switches to the same position.**

14. XLR Output

XLR balanced output.

15. Quarter-inch Input

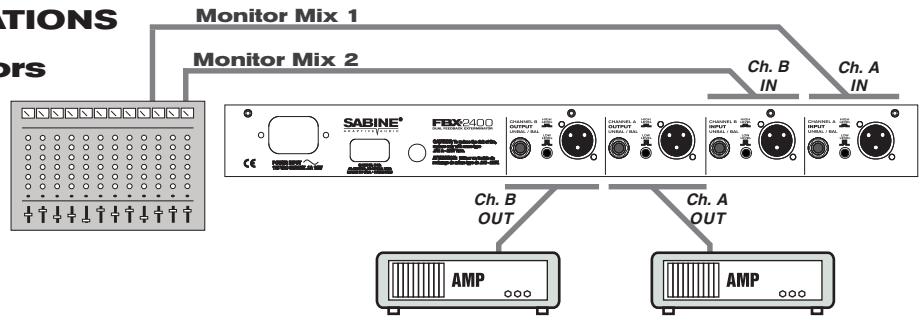
TRS balanced or TS unbalanced input (mixing balanced and unbalanced connections may result in a 6 dB loss of gain). **Important: Refer to section 5.2.**

16. XLR Input

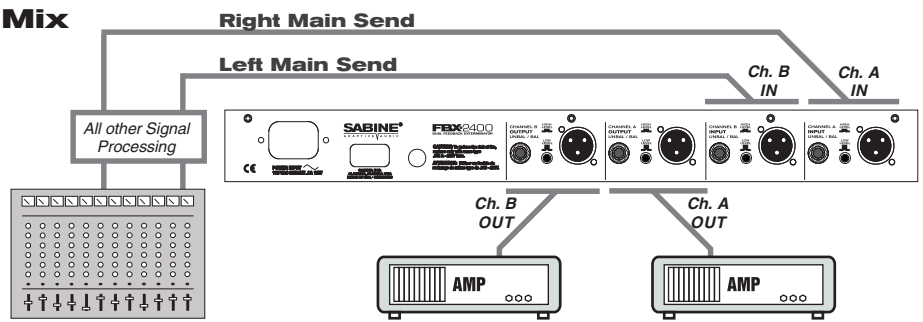
XLR balanced input.

SECTION TWO — APPLICATIONS

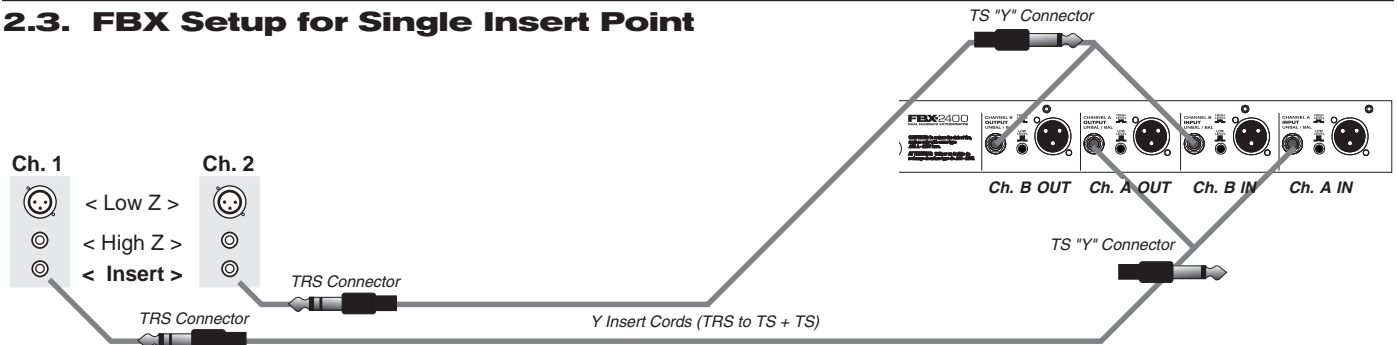
2.1. FBX Setup for Monitors



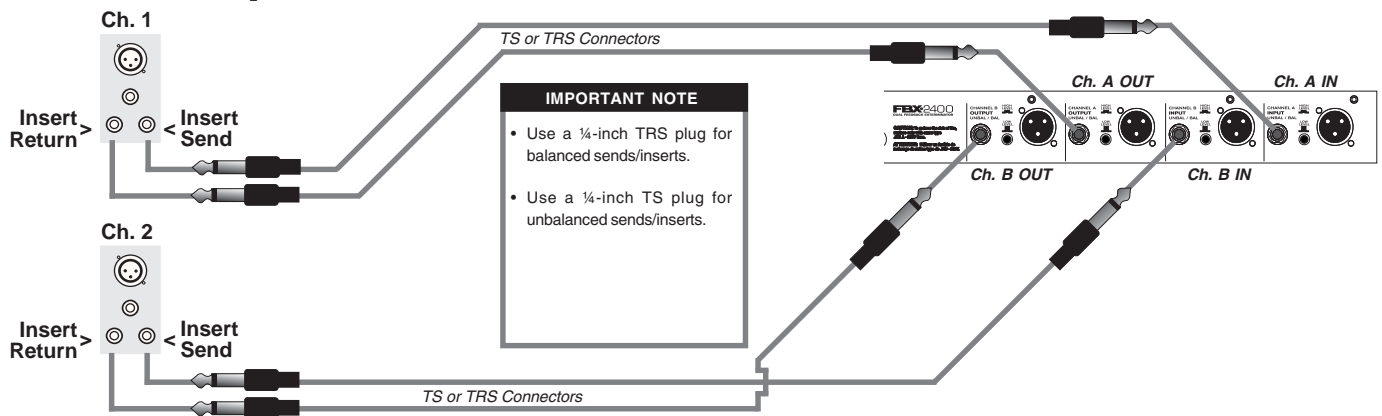
2.2. FBX Setup for Entire Mix



2.3. FBX Setup for Single Insert Point



2.4. FBX Setup for Insert Send & Return



SECTION THREE — ENGINEERING SPECIFICATIONS

FILTERS

- 12 independent digital notch filters per channel, controlled automatically from 40 Hz to 20 KHz.
- Filter width: user-controllable - either 1/10 or 1/5 octave, constant "Q"
- Resolution: 1 Hz
- Time required to find and eliminate feedback: 0.4 seconds, typical @ 1 KHz
- Number of Dynamic vs. Fixed filters per channel: user selectable. Last configuration stored in memory.

*Below approximately 200 Hz the feedback filters become slightly wider to increase the feedback and rumble capture speed at these low frequencies.

INPUT/OUTPUT**

- Input/Output Maximum Signal Levels: Balanced +27dBV peak, unbalanced +21 dBV peak
- Output Drive: Unit will perform as specified driving a load >600 Ohms
- Input Impedance: Balanced or unbalanced >40K Ohms, PIN 2 high
- Output Impedance: Balanced or unbalanced 150 Ohms nominal, PIN 2 high
- Bypass: True power off bypass
- Headroom: +23 dB peak @ 4 dBV nominal input, balanced
- I/O Connectors: XLR-3 and 1/4" TRS

PERFORMANCE***

- Frequency response: 20 Hz – 20 KHz +/- 0.3 dB
- Gain matching: +/- 0.2 dB
- Spectral Variation: +.25 dB, 20 Hz to 20 KHz
- SNR - Dynamic Range: >100 dB
- THD: .005% at 1 KHz < 0.025% 10 KHz – 20 KHz
- Dynamic Range: >105 dB

POWER INPUT

- 115 VAC: 100 – 130 VAC 50/60 Hz
- 230 VAC: 200 – 240 VAC 50/60 Hz

Tests performed using an Audio Precision System One model 322 or equal.

FUSE

- 115 VAC, 0.1 A, 10 W, 0.160 A SB fuse
- 230 VAC, 0.06A, 10 W, 0.080 A T fuse

DIMENSIONS

- 1-U rack mount; 19 x 1.75 x 6.25 in. nominal (rack mountable); 48.3 x 4.5 x 15.9 cm nominal

WEIGHT

- 8.0 lbs. (3.6 kg) nominal

OPERATING TEMPERATURE

- Safe operating temperature: -15 to +50 degrees centigrade ambient temperature (5 to 122F)

SECTION FOUR — OPERATING INSTRUCTIONS

4.1. Before You Begin

These instructions apply to both the FBX1200 and the FBX2400. The 2400 is a dual-mono version of the 1200. Your FBX Feedback Exterminator will improve any sound reinforcement system. The instructions presume that you are familiar with the fundamentals of sound reinforcement.

4.1.1. Where the FBX fits in your sound system:

The most common patch point is between the output of the mixer and the input of a power amp. In this position, the FBX can sense and eliminate feedback occurring in any channel of the mixer. An even better solution is on a mixer insert point for a single channel, or a subgroup (see application diagrams in **Section Two — Applications**). This targets the feedback control to the mics that need it.

Note: If you're using a mixer with unbalanced 1/4" outputs, you must use standard unbalanced cables and connectors when connecting it to the FBX. Similarly, if your mixer is wired for balanced 1/4" Tip-Ring-Sleeve (TRS) outputs, you must use that type of connector. If you don't, you may experience a loss of gain (up to 6 dB) when using the FBX. This can occur if either side of the balanced output is grounded at any point (or when mixing balanced and unbalanced inputs and outputs).

4.1.2. A note about graphic equalizers:

The FBX is designed to replace the graphic equalizer's function for eliminating feedback. In many applications, such as churches, auditoriums or small acoustic ensembles, the mixing board provides all the tonal control that is necessary. The FBX can replace the graphic EQ altogether in some applications; however, a graphic equalizer may be beneficial to shape a system's total performance. If you do want to use an equalizer, place the FBX after the EQ in the signal path. Use the EQ's controls to shape the tonal response of the sound system, but **DO NOT NOTCH FOR FEEDBACK**.

4.1.3. Understanding FIXED and DYNAMIC filters

Before operating the FBX, you need to understand the two types of FBX filters: FIXED and DYNAMIC. FIXED FILTERS retain their frequency center-points until the unit is reset by the user. The system's gain before feedback is limited primarily by the number of fixed filters; i.e., increasing the number of fixed filters increases the system's gain before feedback. In addition, you can LOCK the fixed filters so they do not get any deeper. Locked fixed filters are no longer adaptive. The FBX's DYNAMIC FILTERS control intermittent feedback that comes and goes throughout the program. They are continually reset automatically to different frequencies as new feedback occurs during the program. **For most applications, the optimal setting is nine FIXED and three DYNAMIC FILTERS. This is the factory default.**

4.1.4. Setup & Ready

Your FBX Feedback Exterminator is either in Setup mode or in Ready mode.

Setup Mode: It's quick and quiet, but use this mode for setup only – do not use the FBX for your program while in Setup mode. Think of Setup mode as your key to achieving one of the main benefits of the FBX: getting more gain before feedback. In Setup mode you will be raising the gain of your system so the FBX can place transparent filters (Fixed Filters) that will allow you to get all the gain you need for a loud and clear show. In Setup the FBX is very sensitive so **do not talk into the mics during setup**, and try to keep room noise to a minimum. If the room is noisy, then go into Ready mode and raise your gain while the fixed filters are still unlocked (flashing Ready LED).

Ready Mode: Let the show begin. Your fixed filters are eliminating feedback and giving you extra gain, and your dynamic filters are ready to jump on any new feedback during the show. In this mode your fixed filters are either locked (red LEDs) or unlocked (amber LEDs). We recommend locking your fixed filters for the show. But if you don't have time for the Setup mode, or if the room is just too noisy during setup, then you can start off by unlocking the fixed filters. Leaving the fixed filters unlocked allows them to get deeper if needed, which can be handy if you need to get more gain before feedback. But once your system stabilizes we recommend you lock the fixed filters for the duration of the show!

4.2. How To Operate your FBX1200 / FBX2400

Follow these procedures to get maximum gain before feedback

1 Place equipment & make connections.

- Patch your FBX1200 or FBX2400 into system and make all connections (refer to pages 2 and 3 for connection options).
- Place speakers and microphones in performance positions.
- Set Input and Output levels on FBX back panel (see **Section 5.1.1.** for details). Start with all buttons pushed in.
- If you are using a graphic EQ, adjust only for the desired tonal qualities, but **DO NOT NOTCH FOR FEEDBACK.**
- Adjust the level for each mixer channel, and set the sound system's master volume to minimum.

2 Push SETUP button until all LEDs stop flashing and the SETUP light flashes on its own. Setup mode clears all Fixed &

Dynamic filters. Do not use Setup mode during your performance.

3 Slowly raise the gain on the mixer or amp until the FBX eliminates the first few feedback tones.

DO NOT TALK INTO THE MICS. The FBX will quickly begin to find and remove feedback. The first Fixed filter set will be heard as a quiet feedback chirp and shown as an amber LED. As you slowly raise the gain, more feedback chirps will be heard, and more amber LEDs will light.

a. If you are using stationary microphones:

Continue raising the gain until all filter LEDs cycle back and forth in sequence. This is your indication that the FBX is exiting setup mode.

IMPORTANT: Reduce gain slightly. You are now in **READY** (performance) mode, with the Fixed filters locked and the blue Ready light on. Begin the show!

b. If you are using wireless microphones:

You can get more gain in a variety of locations. To do this, lower the system gain after the first few filters are set, then move the microphone to another area where it will be used and raise the gain slowly as before. Repeat this process while you **continue raising the gain until all filter LEDs cycle back and forth in sequence.** This is your indication that the FBX is exiting setup mode.

IMPORTANT: Reduce gain slightly. You are now in **READY** (performance) mode, with the Fixed filters locked and the blue Ready light on. Begin the show!

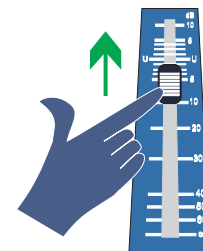
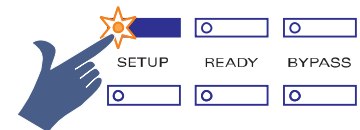
c. You may quit Setup mode at any time prior to its automatic exit by simply pressing the **READY** button (blue READY LED will flash). Press it again at any time to lock the Fixed filters (blue READY LED stays on). Whether locked or unlocked, pressing the READY button before Setup mode automatically finishes will enable ready-to-operate status, but with fewer fixed FBX filters in place. Dynamic FBX filters are still available to eliminate new feedback, regardless of how or when **SETUP** mode is exited. Begin the show!

4 If you do not have time to use Setup Mode:

Push Setup button until all LEDs stop flashing and the SETUP light flashes on its own, then press the READY button -- the blue LED flashes indicating the fixed filters are unlocked. Begin your show, and once several fixed filters are set we recommend you lock them by pushing ready again (blue LED stays lit). You won't get all the potential benefit of increased gain before feedback, but you will get automatic feedback control during your performance.

Power Tips

- Set up one FBX channel at a time.
- DO NOT TALK INTO YOUR SYSTEM** while in Setup mode.
- See **Section 5.2. FBX Filter Control** for information on:
 - Changing the number of Fixed vs. Dynamic filters
 - Selecting and mixing 1/10- & 1/5-octave filters
 - Enabling and setting the Dynamic Filter Timer



Front panel filter LEDs lighting as gain is raised and Fixed filters are set.

FILTER COLOR KEY

FBX Filters	LEDs	Ready LED
Fixed, Locked	RED	Steady BLUE
Fixed, Unlocked	AMBER	Flashing BLUE
Dynamic	GREEN	Either

Fixed & Dynamic Filters

See **Section 4.1.3.** for details on the differences between Fixed and Dynamic FBX filters, and **Section 5.2.2.** for instructions on changing the balance of Fixed versus Dynamic filters.



SECTION FIVE — HOW TO USE FBX FEATURES

5.1. Input / Output Level Switches

Use the two-position switches on the back panel of your FBX1200 / FBX2400 to compensate for input level or output level requirements. NOTE: For unity gain (recommended), set the channel's input & output level switches to the same setting.

NOTE: *Mixing balanced and unbalanced connections may result in a 6 dB loss of gain.*

5.1.1. Setting Levels: Set both Input & Output switches the same for Unity Gain

POSITION	INPUT LEVEL SWITCHES	OUTPUT LEVEL SWITCHES
OUT 	Accepts low level input up to +6 dBu	Outputs at low level, for sending signal to low-level devices or some insert points. See Section 2 for more information on applications.
IN 	Accepts high level input up to +24 dBu	Outputs at high level, for most line-level devices. See Section 2 for more information on applications.

5.2. FBX Filter Control

5.2.1. Selecting Filter Width

If you're using the FBX for a music application, the standard 1/10-octave constant "Q" filter is most effective. However, in spoken word applications, such as lectures or teleconferencing, we recommend using the wider 1/5-octave filter for more robust feedback control. You may enable the 1/5-octave filters by pressing the FIFTH OCTAVE button, and the built-in LED will light. Only filters set after pressing the button in will be 1/5-octave. Press the button again to set subsequent filters to standard 1/10-octave filters.

5.2.2. Setting Number of Fixed vs. Dynamic Filters

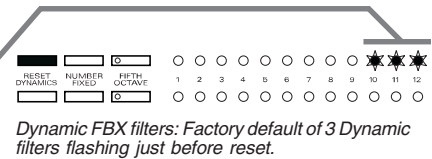
To change the number of Fixed filters from the factory default of 9 Fixed and 3 Dynamic per channel, push the NUMBER FIXED button for 4 seconds. The filters LEDs will flash 4 times and then go out. Release the NUMBER FIXED button, and the LEDs will begin to light in sequence. When the LED corresponding to the desired number of Fixed filters lights, press the NUMBER FIXED button again.

IMPORTANT TIP: You can mix 1/10- and 1/5-octave filters in the same channel. If you have an especially bad feedback problem, try making the first few filters 1/5-octave filters.

5.2.3. Resetting FBX Filters

All FBX filters: To reset all FBX filters, follow the directions in **Section 4.2**.

Dynamic FBX filters only: To reset only Dynamic filters, press RESET DYNAMICS until the current Dynamic filter LEDs flash and then turn off. Release the button.



5.2.4. Dynamic Filter Timer

The Dynamic Filter Timer, *when enabled*, automatically resets Dynamic filters after a user-selected time has passed (refer to Timer Settings chart at right).

5.2.4.1. Set the Dynamic Filter Timer

- Press and hold the RESET DYNAMICS button. The Dynamic LEDs flash twice and reset. Continue holding the button and the current Dynamic Filter Timer setting will flash twice (filter LEDs 1-5, see Filter Timer Chart at right).
- Release the RESET DYNAMICS button and filter LEDs 1-5 will cycle through the possible timer settings.
- Press RESET DYNAMICS again at the desired timer setting. LEDs will flash twice (including filter LEDs indicating the current timer setting). Your Dynamic Filter Timer is now set. The timer starts individually for each Dynamic filter.



TIMER SETTINGS	LEDs
Off	★ ○ ○ ○ ○ 1 2 3 4 5
1 min.	★ ★ ○ ○ ○ 1 2 3 4 5
5 min.	★ ★ ★ ○ ○ 1 2 3 4 5
30 min.	★ ★ ★ ★ ○ 1 2 3 4 5
60 min.	★ ★ ★ ★ ★ 1 2 3 4 5

5.3. Important Operating Considerations

5.3.1. Power-Off Memory

The FBX stores the positions and depths of the filters in nonvolatile internal memory when the unit is turned off or during a power failure. The unit will return all filters to their previous frequencies and depths when it is turned back on.

5.3.2. Bypass Mode

The FBX has a true power-off bypass. The signal is unaffected in Bypass mode even if the unit is turned off.

5.3.3. Setup Mode

NOTE: Setup mode is for pre-performance audio setup only, and will cause distortion in your audio program if left on during performance. You must follow the setup procedure outlined in the previous section, and do not play program during Setup mode. Otherwise the FBX will clip and filters may be set improperly. (Clip level is set to the lowest level so the feedback clips quickly; therefore, your program will also be clipped in setup mode. Be sure a dynamic filter is set, and if one isn't, press the READY button before your program begins.) **You'll know the FBX1200 / FBX2400 is in setup mode when the SETUP button is lit.** NOTE: You can manually override Setup mode if necessary.

5.3.4. Mobile vs. Stationary Microphones

One significant advantage offered by the Sabine family of FBX Feedback Exterminator products is their ability to adapt to changing acoustical relationships involving sound system components in various applications. One major source of potential feedback problems arises in situations with wireless microphones, when the user of the wireless mic is moving around the performance area. As a microphone moves in a sound space, with varying degrees of proximity to the speakers and varying acoustic responses, feedback frequencies may shift. In such a situation, feedback-free mobility may be more important a concern than maximum system gain.

For this reason we recommend setting FBX filters for mobile microphones by moving to the various possible microphone locations and setting filters for those locations. As the Setup instructions show, raise the system gain and set the FBX filters in each predictable location.

In some situations, increasing the number of dynamic filters (versus fixed FBX filters) may allow a second layer of defense against new feedback from new locations. This technique is recommended if you cannot predict where the performer may roam. But fixed FBX filters placed in the setup procedure are still your best bet because the feedback filters are already set.

SECTION SIX — TROUBLESHOOTING TIPS

Q. Can I place the FBX in the mixer's EQ loop?

A. Yes.

Q. Can I place the unit in the mixer effects loop?

A. Avoid this configuration. You can configure the system this way only if each effects send of each mixer channel is set so that all of the signal is routed completely through the effects loop. You cannot mix dry signal with effects signal and still control feedback.

Q. The signal input LEDs do not light. The unit will not catch feedback. Why?

A. The unit is not in the signal path. Check the connections. Be sure that the program is interrupted when the input is disconnected from the back of the unit.

Q. Can I mix balanced and unbalanced inputs and outputs?

A. Yes. An unbalanced input and balanced output is compatible. However, a balanced input and unbalanced output will result in a 6 dB loss of dynamic range. **Refer to section 5.3.5. for more details.**

Q. Why does one of the FILTER ACTIVITY LEDs blink?

A. The last filter to be automatically updated blinks. During normal operation, the blinking will move from filter to filter as they are reset. This gives the user a visual confirmation that the unit is responding to new feedback and is functioning properly.

Q. Sometimes during the initial setup, the first filter LED will blink before any feedback has been introduced into the system. Why?

A. The FBX will set a filter if the system has a hum. Check for bad grounds. Try resetting the filters and/or the Ground switch on the rear panel.

Q. Why does my system sound thin and muffled?

A. Place the FBX in BYPASS MODE. If the system still sounds thin, your problem is probably improper use of a graphic EQ. If the problem is really the FBX, re-initialize the system and make sure the READY button LED is on steadily.

Q. Why does my program sound clipped and distorted?

A. Make sure you are not in Setup mode. Setup mode turns off automatically after the first dynamic filter is set, or you can turn it off manually by pressing the READY button. See Section 4.3.3. for information on Setup mode.

Q. Can I patch two FBX channels together for twice the filters?

A. Yes; connect the output of one FBX channel to the input of the other channel. Place the FBX between the output of the mixer and the input of a power amp, and set up the channels sequentially. When combining channel A with channel B on an FBX2400, bypass channel B while setting up channel A, then lock channel A's fixed filters (all channel A's filters should be fixed) by pressing channel A's READY button on the front panel after setup. The blue READY LED should remain lit.

Q. Why doesn't the FBX1200 & FBX2400 Series filter feedback immediately?

A. Four possible reasons:

1. Lower frequencies may take longer than higher ones.
2. Check input level of signal at the unit and set gain so the signal level LED's on the unit light up.
3. It may be patched in an "effects loop", not directly in the signal path. This WILL NOT WORK.
4. You may have used all 12 filters. Dynamic filters will continue to operate by notching feedback frequencies as they occur, but ultimately, gain will exceed filter capacity.

SECTION SEVEN — FBX THEORY & PRACTICE

7.1. Introduction to FBX®

WHY FBX? Feedback is certainly the most pervasive challenge to the audio industry. The potential appearance of sudden, loud, out-of-control feedback is every sound engineer's and musician's nightmare. Unlike more subtle audio quality problems or shortcomings, feedback is embarrassingly obvious — it disturbs the performer, the audience, and the technician, and can damage equipment and just generally ruin your day.

Feedback is a potential problem in any amplified sound system that places a microphone or pickup in proximity to a loudspeaker. Poor acoustical conditions or misguided use by unsophisticated sound system operators only aggravate the situation. To make matters still worse, a non-Sabine variety of wireless microphone adds yet another level of feedback danger to the picture. Since feedback erupts whenever the distance, location, and gain relationships between a speaker and a microphone reach a critical combination, a mic that can move anywhere results in an ever changing potential for feedback. A step in the wrong direction may change a clear sound to a piercing shriek in less than a second. This enhanced potential for feedback with a wireless system gets worse if lavalier microphones are used. Such microphones are usually placed farther from the mouth than handheld or head set microphones, thus requiring more gain. Also, the polar pattern of a lavalier microphone is frequently omnidirectional. Thus, the likelihood of feedback increases, due to the microphone's increased off-axis sensitivity to the sound emanating from the loudspeakers.

The Sabine FBX1200 and FBX2400 systems solve feedback problems by precise attenuation of very narrow bands of feedback-prone frequencies. The process is automatic, simple to use, adaptable to changing acoustical conditions and relationships, powerful in its application, and has minimal consequences to the audio fidelity of the signal. We call this automatic filter an FBX Feedback Exterminator® filter, or FBX filter for short.

7.2. The Advantages of FBX Filters

Before the invention of FBX, the most common device for controlling feedback was the 31-band graphic EQ. However, an FBX filter offers three distinct advantages over graphic filters.

1. First and most obvious is the automatic nature of FBX filters. When feedback occurs, FBX responds more quickly than even the most experienced engineer. Automatic FBX placement works even in the presence of audio program material, intelligently distinguishing feedback from music or speech.
2. A second advantage is that FBX micro-filters are precisely placed anywhere feedback occurs (with 1 Hz resolution), while graphic EQ filters are limited to 31 fixed center points. An FBX filter represents a direct hit on feedback! In contrast, a graphic EQ filter can only approximate the exact frequency of the feedback, and the filter (or filters) with the closest center frequency must be pulled down. Such filters are deepest at their centers, and such imprecise attenuation takes a big (and unnecessary) chunk out of your sound (see figure 7a).
3. Increased clarity and gain-before-feedback are further accomplished by the third and most important advantage of FBX: Sabine's micro-filters are ten times narrower than 31-band EQ filters. Using FBX micro-filters will return up to 90 percent of the power removed by EQ filters.

Here's a good place to make a very important distinction. Graphic EQ filters are typically called "1/3-octave," but it's important to understand that this term refers to the spacing of the filter centers (1/3-octave apart), and not the width of the filter (usually a full octave). Graphic filters thus overlap one another, and affect frequencies well above and below the center point frequency, including frequencies of adjacent bands. This makes graphic equalizers very practical tools for shaping sound "with broad strokes," such as dialing in overall system EQ, but results in destructive audio quality overkill when they are used to eliminate feedback. A graphic equalizer would need more than 10,000 narrow-band sliders to be as precise and powerful as your FBX.

As an example of the power of FBX, figure 7b shows test results measured with a PA set up consisting of a microphone, mixer, FBX Feedback Exterminator®, power amp and two speakers. The system's gain was first raised until the FBX removed nine feedback points. Next, the FBX was replaced with a graphic EQ. The EQ was adjusted while the system gain was raised to the same level achieved with the FBX. The frequency response curves of each device were then plotted and are compared in figure 7b. Note how much more of the program (the "good audio") is eliminated using an EQ — whereas only feedback is eliminated using FBX filters.

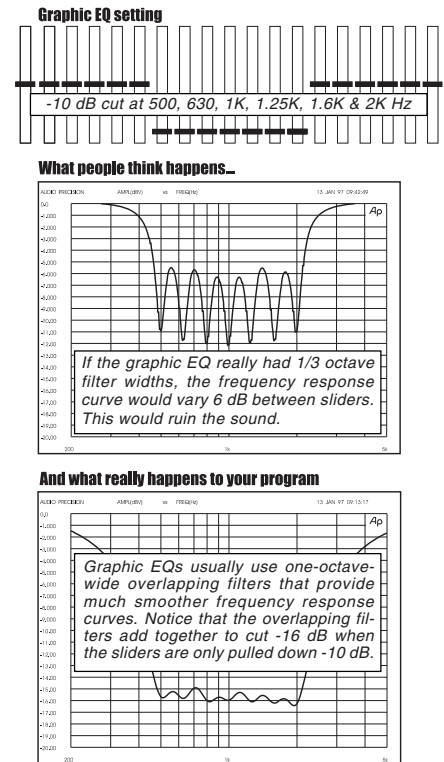


Fig. 7a.

7.3. Parametric Filters and FBX

Of course, many savvy sound engineers, realizing the limitations of graphic equalizers in removing problem feedback, prefer to use a different type of equalizer, called a parametric EQ, for such applications. If you're one such audio engineer, you'll be comforted to know that FBX filters share much in common with parametrics.

Compared to graphic filters, parametrics allow more precise adjustments — specifically, control of filter width, the amount of boost or cut, and the mid-band frequency of the filter. This greater precision, however, comes at a price, as parametric filters are not nearly as intuitive or simple to use as graphic equalizers.

Nothing, however, is easier to use than an FBX filter, which enjoys the precision of a parametric filter, yet deploys instantly and automatically whenever feedback is detected. Effectively, an FBX filter is a parametric filter set to a tenth-octave width, restricted to cut-only activity, and automatic in its choice of frequency band.

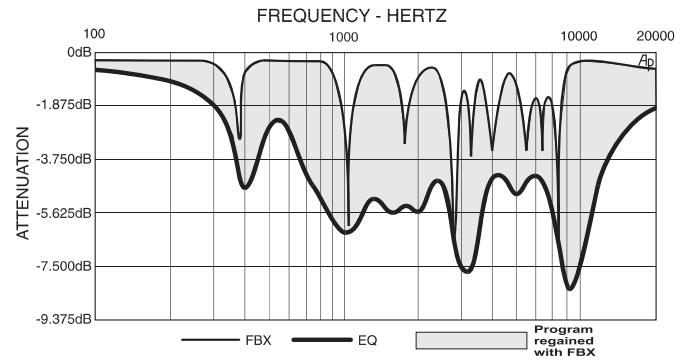


Fig. 7b.

7.3.1. Dynamic FBX Filters

Dynamic FBX filters also set automatically, but can change frequency, on a rotating basis, as the need arises. To help distinguish dynamic from fixed filters, consider the example of a speaker using a wireless lavalier microphone, who walks under a ceiling speaker for the first time. In so doing, he enters a location-specific feedback zone, where it's possible that a problem frequency may have escaped detection and notching by a fixed filter. If all fixed filters have been deployed, a dynamic filter will be set automatically as soon as feedback appears, solving the problem. Great! But what happens when the speaker then moves away from the ceiling speaker, and close to a floor monitor? Feedback from the ceiling speaker is no longer a problem, but a new frequency starts to squeal. If all fixed and dynamic FBX filters are already set, a dynamic filter will change, to adjust to the new location. An FBX dynamic filter thus stands guard if new problem feedback arises after all available filters have been set, providing a deeper and more flexible level of protection against the dreaded surprise of feedback. Other than the ability to change frequency, a dynamic filter is equivalent to a fixed filter.

7.3.2. Balancing Fixed & Dynamic Filters

Your FBX1200, and each channel of your FBX2400, offer a total of 12 FBX filters (combined fixed and dynamic), which can be used as needed to exterminate feedback. After years of experience and experimentation, Sabine has settled upon a default balance of 9 fixed and 3 dynamic filters, set at the factory. This default condition can be changed to any combination you require.

If you follow setup instructions for setting FBX filters, your FBX1200/FBX2400 will automatically exit SETUP mode (enter READY status) after all fixed filters, and the first dynamic filter, have set. In the default condition, this means you will have set ten filters (nine fixed and one dynamic), with two dynamic filters still not set and remaining on standby alert. If you wish to set fewer filters, press the READY button before SETUP automatically exits, after you have set enough filters to safely achieve your desired gain level. In that case, in the factory default condition, you will reserve three available dynamic filters for standby.

7.3.3. FBX Filter Width

Sabine's experience and testing with filters and sound quality alone led us to decide upon a default FBX filter width of .10 (one-tenth) octave as the optimal notch width, able to eliminate feedback without affecting music programs. If, with all filters properly set, feedback is still a problem, FBX filters may be set to .20 (one-fifth) octave width. This wider filter setting will help to better eliminate feedback trouble areas, but may also affect music programs slightly. Therefore, the wider setting is generally considered to be appropriate where speech (less demanding than music) is the primary application. You can globally change FBX filter width by pressing the FIFTH button on the front panel. The width of any set filter will always be determined by the position of the switch at the time the filter is created.

7.3.4. Who Benefits from FBX?

Virtually every sound system will be improved with the Sabine feedback control. Singers and speakers who do not have sound technicians can now increase their monitor or house system volume so they can hear themselves clearly and with full fidelity, without worrying if their microphones will suddenly squeal if they move to the wrong place.

Auditoriums and churches of all sizes will enjoy reliable feedback control. Hotels and conference centers around the world can offer meeting rooms with microphones that won't howl during programs. Sabine FBX systems can be installed in theaters, schools, sports arenas, courtrooms, teleconferencing rooms, intercoms or interactive remote classrooms — anywhere one or multiple microphones are used.

SECTION EIGHT — CAUTIONS & WARRANTY

Warning! This equipment must be earthed.
Caution! Risk of electric shock. Do not open.
Caution! Shock hazard. Do not remove covers. No user serviceable parts inside. Refer servicing to qualified service personnel.
Warning! To reduce the risk of fire or electric shock, do not expose this product to rain or moisture.

Attention! Cet appareil doit être relié à la terre.
Attention! Risque de choc électrique; ne pas ouvrir.
Attention! Gefahr eines elektrischen Stromschlags. Gehäuse nicht öffnen.
Attention! Pour réduire le risque d'incendie ou de choc électrique, ne pas laisser l'appareil sous la pluie ou à l'humidité.

Achtung! Dieses Gerät muss schutzgeerdet sein.
Achtung! Gefahr eines elektrischen Stromschlags. Gehäuse nicht öffnen.
Achtung! Gefahr eines elektrischen Stromschlags. Gehäuse nicht öffnen. Keine von Benutzer zu bedienenden Teile im Geräteinneren.
Überlassen Sie das Gerät zu Servicezwecken nur geschultem Fachpersonal.
Um Brandgefahr oder das Risiko eines elektrischen Schlags auszuschließen, das Gerät vor Nässe und Feuchtigkeit schützen.

Advertencia! Este equipo debe estar conectado a tierra.
Precaución! Riesgo de descarga eléctrica. No abrir.
Precaución! Riesgo de descarga eléctrica. No desmontar las tapas. Piezas interiores no reparables por el usuario. Reparable sólo por personal cualificado.
Advertencia! Para reducir el riesgo de incendio o de descarga eléctrica no exponga este producto a la lluvia o humedad.

FCC Statement:

This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) This device may not cause harmful interference; and (2) This device must accept any interference received, including interference that may cause undesired operation. *Warning:* Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.


Canadian Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.


Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class B prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

Japanese EMI Compliance Statement

この装置は、第二種情報装置
(住宅地域又はその隣接した地域において使用されるべき情報装置)
で住宅地域での電波障害防止を目的とした情報処理装置等電波障害
自主規制協議会 (VCCI) 基準に適合しております。
しかし、本装置をラジオ、テレビジョン受信機に近接してご使用に
なると、受信障害の原因となることがあります。
取扱説明書に従って正しい取り扱いをして下さい。



Warning!




The FBX1200 & FBX2400 Series is designed to operate from standard AC power. Please be sure the power in your area is compatible with the power requirements marked on the rear of the unit. Using the wrong input voltage may cause permanent damage to the unit and will void the warranty.

The FBX1200 & FBX2400 Series is supplied with one of the following AC power cords:

Japan	100 VAC
U.S./North America	120 VAC
Continental Europe	230 VAC
United Kingdom	240 VAC
Australia	240 VAC



Caution!



Replace the fuse with a fuse of exactly the same rating specified on the rear of the product.

1. Read all safety and operating instructions before using this product.
2. All safety and operating instructions should be retained for future reference.
3. Obey all cautions in the operating instructions and on the unit.
4. All operating instructions should be followed.
5. Use only shielded audio and data cables.
6. This product should not be used in the presence of moisture or rain, or near any water, i.e., a bathtub, sink, swimming pool, wet basement, etc.
7. This product should be located so that its position does not interfere with proper ventilation. Do not use in direct sunlight. Do not place flat against a wall or in a built-in enclosure that will impede the flow of cooling air.
8. This product should not be placed near a source of heat such as a stove or radiator.
9. Connect only to a power supply of the type marked on the unit adjacent to the power entry module.
10. Never break off the ground pin on the power supply cord.
11. Power supply cords should always be handled carefully. Never walk or place equipment on power supply cords. Periodically check cords for cuts or signs of stress, especially at the plug and the point where the cord exits the unit.
12. The power supply cord should be unplugged when the unit is to be unused for long periods of time.
13. Care should be taken so that objects do not fall and liquids are not spilled into the unit through the ventilation holes or any other openings.
14. This unit should be checked by a qualified service technician if:
 - A. The power supply cord or plug has been damaged.
 - B. Anything has fallen or been spilled into the unit.
 - C. The unit does not operate correctly.
 - D. The unit has been dropped or the enclosure damaged.
15. The user should not attempt to service this equipment. All service work should be done by a qualified service technician.

OSHA 2201; 1995 revised.



EXPOSURE TO EXTREMELY HIGH NOISE LEVELS MAY CAUSE A PERMANENT HEARING LOSS. INDIVIDUALS VARY CONSIDERABLY IN SUSCEPTIBILITY TO NOISE-INDUCED HEARING LOSS, BUT NEARLY EVERYONE WILL LOSE SOME HEARING IF EXPOSED TO SUFFICIENTLY INTENSE NOISE FOR A SUFFICIENT TIME. THE U.S. GOVERNMENT'S OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) HAS SPECIFIED THE NOISE LEVEL EXPOSURES AT RIGHT AS PERMISSIBLE :

ACCORDING TO OSHA, ANY EXPOSURE IN EXCESS OF THE ABOVE PERMISSIBLE LIMITS COULD RESULT IN HEARING LOSS. EAR PLUGS OR PROTECTORS IN THE EAR CANALS OR OVER THE EARS MUST BE WORN WHEN OPERATING THIS DEVICE IN ORDER TO PREVENT A PERMANENT HEARING LOSS, IF EXPOSURE IS IN EXCESS OF THE LIMITS AS SET FORTH ABOVE. TO ENSURE AGAINST POTENTIALLY DANGEROUS EXPOSURE TO HIGH SOUND PRESSURE LEVELS, IT IS RECOMMENDED THAT ALL PERSONS EXPOSED TO EQUIPMENT CAPABLE OF PRODUCING HIGH SOUND PRESSURE LEVELS SUCH AS THIS DEVICE BE PROTECTED BY HEARING PROTECTORS WHILE THIS UNIT IS IN OPERATION.

DURATION PER DAY, HOURS

SOUND LEVEL dBA SLOW RESPONSE

8	90
6	92
4	95
3	97
2	100
1-1/2	102
1	105
1/2	110
1/4 or less	115

<http://www.osha.gov>
1926.52(d)(1)

LIMITED WARRANTY

THIS LIMITED WARRANTY VALID ONLY WHEN PURCHASED AND REGISTERED IN THE UNITED STATES OR CANADA. ALL EXPORTED PRODUCTS ARE SUBJECT TO WARRANTY AND SERVICES TO BE SPECIFIED AND PROVIDED BY THE AUTHORIZED DISTRIBUTOR FOR EACH COUNTRY.

Ces clauses de garantie ne sont valables qu'aux Etats-Unis et au Canada. Dans tous les autres pays, les clauses de garantie et de maintenance sont fixées par le distributeur national et assurées par lui selon la législation en vigueur.

Diese Garantie ist nur in den USA und Kanada gültig. Alle Export-Produkte sind der Garantie und dem Service des Importeurs des jeweiligen Landes unterworfen.

Esta garantía es válida solamente cuando el producto es comprado en E.U. continentales o en Canada. Todos los productos que sean comprados en el extranjero, están sujetos a las garantías y servicio que cada distribuidor autorizado determine y otorgue en los diferentes países.

ONE-YEAR LIMITED WARRANTY/REMEDY

SABINE, INC. ("SABINE") warrants this product to be free from defects in material and workmanship for a period of one (1) year from date of purchase PROVIDED, however, that this limited warranty is extended only to the original retail purchaser and is subject to the conditions, exclusions and limitations hereinafter set forth:

CONDITIONS, EXCLUSIONS AND LIMITATIONS OF LIMITED WARRANTIES

These limited warranties shall be void and of no effect if:

- a. The first purchase of the product is for the purpose of resale; or
- b. The original retail purchase is not made from an AUTHORIZED SABINE DEALER; or
- c. The product has been damaged by accident or unreasonable use, neglect, improper service or maintenance, or other causes not arising out of defects in material or workmanship; or
- d. The serial number affixed to the product is altered, defaced or removed; or
- e. The power supply grounding pin is removed or otherwise defeated. In the event of a defect in material and/or workmanship covered by this limited warranty, Sabine will repair the defect in material or workmanship or replace the product, at Sabine's option; and provided, however, that, in any case, all costs of shipping, if necessary, are paid by you, the purchaser.

WARRANTY REGISTRATION CARD SHOULD BE COMPLETED AND RECEIVED BY SABINE WITHIN FOURTEEN (14) DAYS OF THE DATE OF YOUR PURCHASE.

In order to obtain service under these warranties, you must:

- a. Bring the defective item to any Authorized SABINE DEALER and present therewith the ORIGINAL PROOF OF PURCHASE supplied to you by the AUTHORIZED SABINE DEALER in connection with your purchase from him of this product. If the DEALER is unable to provide the necessary warranty service, you will be directed to the nearest other SABINE AUTHORIZED DEALER which can provide such service. OR
- b. Ship the defective item, prepaid, to:

SABINE, INC.
13301 HIGHWAY 441
ALACHUA, FL 32615-8544

Includetherewith a complete, detailed description of the problem, together with a legible copy of the original PROOF OF PURCHASE and a complete return address. Upon Sabine's receipt of these items:

- a. If the defect is remedial under the limited warranties and the other terms and conditions expressed have been complied with, Sabine will provide the necessary warranty service to repair or replace the product and will return it, FREIGHT COLLECT, to you, the purchaser.
- b. Sabine's liability to the purchaser for damages from any cause whatsoever and regardless of the form of action, including negligence, is limited to the actual damages up to the greater of \$500.00 or an amount equal to the purchase price of the product that caused the damage or that is the subject of or is directly related to the cause of action. Such purchase price will be in effect for the specific product when the cause of action arose. This limitation of liability will not apply to claims for personal injury or damage to real property or tangible personal property allegedly caused by Sabine's negligence. Sabine does not assume liability for personal injury or property damage arising out of or caused by a non-Sabine alteration or attachment, nor does Sabine assume any responsibility for damage to interconnected non-Sabine equipment that may result from the normal functioning and maintenance of the Sabine equipment.

UNDER NO CIRCUMSTANCES WILL SABINE BE LIABLE FOR ANY LOST PROFITS, LOST

SAVINGS, ANY INCIDENTAL DAMAGES OR ANY CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT, EVEN IF SABINE HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

THESE LIMITED WARRANTIES ARE IN LIEU OF ANY AND ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE; PROVIDED, HOWEVER, THAT IF THE OTHER TERMS AND CONDITIONS NECESSARY TO THE EXISTENCE OF THE EXPRESS LIMITED WARRANTIES, AS HEREINABOVE STATED, HAVE BEEN COMPLIED WITH, IMPLIED WARRANTIES ARE NOT DISCLAIMED DURING THE APPLICABLE ONE-YEAR PERIOD FROM DATE OF PURCHASE OF THIS PRODUCT.

SOME STATES DO NOT ALLOW LIMITATION ON HOW LONG AN IMPLIED WARRANTY LASTS, OR THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS OR EXCLUSIONS MAY NOT APPLY TO YOU. THESE LIMITED WARRANTIES GIVE YOU SPECIFIC LEGAL RIGHTS, AND YOU MAY ALSO HAVE OTHER RIGHTS WHICH MAY VARY FROM STATE TO STATE.

THESE LIMITED WARRANTIES ARE THE ONLY EXPRESS WARRANTIES ON THIS PRODUCT, AND NO OTHER STATEMENT, REPRESENTATION, WARRANTY OR AGREEMENT BY ANY PERSON SHALL BE VALID OR BINDING UPON SABINE.

In the event of any modification or disclaimer of express or implied warranties, or any limitation of remedies, contained herein conflicts with applicable law, then such modification, disclaimer or limitation, as the case may be, shall be deemed to be modified to the extent necessary to comply with such law.

Your remedies for breach of these warranties are limited to those remedies provided herein, and Sabine gives this limited warranty only with respect to equipment purchased in the United States of America.

INSTRUCTIONS — WARRANTY REGISTRATION

- Mail the completed WARRANTY REGISTRATION CARD to:

SABINE, INC.
13301 HIGHWAY 441
ALACHUA, FL 32615-8544

- Or, register online at www.Sabine.com

IMPORTANT: Be sure to keep the PROOF OF PURCHASE. In the event warranty service is required during the warranty period, you will need this document. There will be no identification card issued by Sabine, Inc.

IMPORTANCE OF WARRANTY REGISTRATION & NOTIFICATION OF ADDRESS CHANGE:

- a. Should notification become necessary for any condition that may require correction, the REGISTRATION CARD will help ensure that you are contacted and properly notified.
- b. Notice of address changes — If you move from the address shown on the WARRANTY REGISTRATION CARD, you should notify Sabine of the change of address so as to facilitate your receipt of any bulletins or other forms of notification which may become necessary in connection with any condition that may require dissemination of information or correction.

You may contact Sabine directly by telephoning (386) 418-2000.

Please have the Sabine product name and serial number available when communicating with Sabine Customer Service.



SABINE FBX SETUP

ACTION	CONTROLS	LED STATUS	FIXED FILTERS	DETAILS
1 Push & Hold SETUP Do Not Talk into Mics!				LEDs will flash 5 times, followed by the SETUP button LED flashing. You are now in FBX Setup mode. Do not speak into the mic or play program through the system.
2 Raise Gain Slowly				Raise gain slowly. Fixed filter LEDs will flash amber and then remain lit one at a time as filters are set. Wireless Mics: If you are using a wireless mic, stop raising gain after a few filters and move the microphone to another performance area, continue slowly raising gain and repeat.
3 When Filter LEDs cycle left & right, Stop Raising Gain				Stop raising gain when all filter LEDs light back and forth in sequence and turn red; the first Dynamic filter (green LED) is also set. Setup has now completed. You are ready to go! Important: Reduce gain slightly. This will be your maximum gain setting.
4 Or... Push READY anytime to exit Setup Mode				Push READY button at any time to exit Setup mode. You are ready to go. The blue LED will flash. Push READY again at any time to Lock Fixed filters - the blue LED stays lit. See the operating guide for more information on locking fixed filters.

For complete instructions, please read the operating guide!



Register your FBX equipment online at Sabine.com

