

PCM 80
Vocal Fix
Algorithm Card

User Guide

lexicon

Unpacking and Inspection

After unpacking the Vocal Fix Algorithm Card, save all packing materials in case you ever need to ship the card. Thoroughly inspect the card and packing materials for signs of damage. Report any shipment damage to the carrier at once; report equipment malfunction to your dealer.

Precautions

This is a read only card.

Use only with the Lexicon PCM 80, software version 1.10 or higher.

To avoid damage to the card, do not expose to rain or moisture, extreme temperatures, direct sunlight, or extreme shock.

In the event the card is dropped, damaged, or exposed to liquids, do not insert it into the PCM 80.

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Thank you for your purchase of the PCM 80 Vocal Fix Algorithm Card. The card contains a Pitch Correct algorithm which is specifically designed to help fix pitch problems on previously recorded solo vocal tracks. The presets provide a variety of easy to use tools, many of which are designed for MIDI keyboard control of pitch correction.

The algorithm combines an intelligent pitch shifter with a PCM 80 Chamber reverb. While this is a true stereo algorithm, it is designed to work with monophonic (one note at a time) vocal sources.

Controls for the algorithm are arranged in a PCM 80-type matrix. The audio parameters are identical to those in the PCM 80. New control parameters are found in the Control row and a new Pitch row.

As in the PCM 80, some of the 10 presets have one or more parameters patched to the front panel ADJUST knob, giving you instant control over the primary aspect of the effect — without going into Edit mode.

We hope you will find the Vocal Fix card easy to use, and a great extension of the power of your PCM 80. To get the most out of the card, we suggest that you invest the time to explore this manual. We think you'll agree that the time spent investigating will reward you with enjoyment of the full capabilities of the card.

Introduction



Note: The reverb mix or level is turned down or off in all of the Vocal Fix presets, as the amount of reverb appropriate for a given application is very dependent on what else is going on in the mix. We've already set the reverb parameters to values that will work well with the pitch effect — all you need to do is turn up the appropriate reverb parameter (**Rvb Mix** or **RvbOutLvl** in row 1 of any edit matrix).

Vocal Fix Card Operation

The Vocal Fix Algorithm Card is a standard PCMCIA card designed to be used with the Lexicon PCM 80 (version 1.10 or higher). Care and handling of the card, as well as some routine precautions are noted here. Please review these before using the card to avoid damage to the card, as well as abnormal behavior in the PCM 80. Refer to your PCM 80 User Guide for information on troubleshooting the PCM 80 itself.

Handling the Algorithm Card

The Vocal Fix Algorithm Card is designed for use ONLY with the PCM 80 V1.10 or higher.

Care and Handling

The Vocal Fix card is a Read Only Memory Card which cannot be overwritten. It will only load properly into PCM 80s running 1.10 or higher software.

Handle cards with care.

Do not bend the card, or subject it to moisture, extreme temperature, direct sunlight, or extreme shock.

Insert card completely before attempting card operations.

Incomplete card insertion can cause abnormal behavior.

Card Insertion

Do not press EJECT while loading the card.

If the card is inserted before the PCM 80 is powered on, wait for the completion of Power On Diagnostics and the loading of the first program before attempting to use or remove the card.

Operational Behavior

Card algorithms will be loaded automatically into the PCM 80 on power on. Removing the card before the completion of the normal PCM 80 power on cycle may cause abnormal behavior.

Once the algorithms have been loaded from the card, you can either remove the card, or leave it in the PCMCIA card slot.

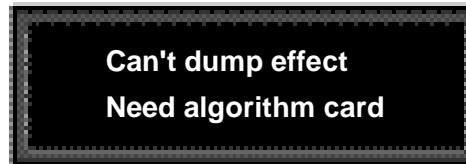
While the PCM 80 is running an extension card algorithm, it will not load a second algorithm card.

Recognition of a second algorithm card requires returning to the PCM 80's internal memory by loading a preset or register from one of the internal algorithms before loading the new algorithm card.

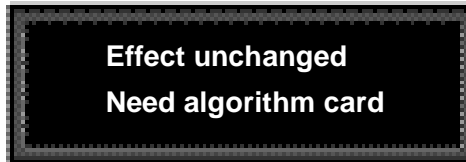
MIDI SysEx register dumps require that the algorithm card used to create the effect(s) be loaded.

Be aware that, if you create a bank of registers with effects created from more than one algorithm card, you will need to perform separate SysEx dumps for each card used.

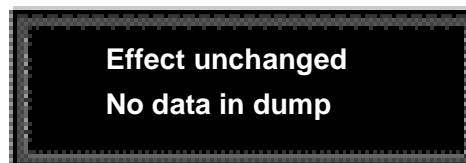
The algorithm used to create an effect must be loaded into the PCM 80 for a SysEx dump to occur. If you do not have the appropriate algorithm card loaded into the *transmitting* PCM 80, the data for the effect is not transmitted and the following message is displayed:



If you do not have the appropriate algorithm card loaded into the *receiving* PCM 80 when a valid SysEx for an effect created from a card algorithm is received, the following message is displayed:



A placeholder is transmitted for any register which cannot be dumped due to the absence of an algorithm card. This placeholder contains the program name and algorithm number, but no effect parameter data. This allows an editor to identify registers which were not sent, and the algorithm card which must be loaded to complete the dump. The PCM 80 will always ignore the placeholder, and will display the following message when a placeholder is received:



Note that registers made from algorithm cards *can* be freely copied between the PCM 80's internal register bank (R) and RAM card banks (C0, C1, etc.) without loading the algorithm card.

In order to run the Vocal Fix algorithm, the software must be loaded into the PCM 80's "extension" memory. To do this:

Loading the Vocal Fix Pitch Correct Algorithm

If the PCM 80 is turned off:

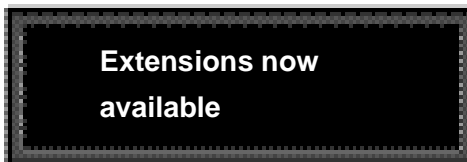
1. Insert the Vocal Fix algorithm card into the PCMCIA card slot.
2. Power up the PCM 80. The software will be loaded automatically.

If the PCM 80 is already running:

1. Insert the Vocal Fix algorithm card into the PCMCIA card slot.
2. Press **Control** and use **SELECT** and **Up** and **Down** to go to **Control 2.1**. The following message should appear:

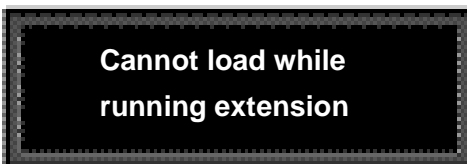


3. Press **Load/★**. The following message will appear briefly to indicate the load was completed:



If the PCM 80 is running an algorithm from a different extension card:

Loading a different algorithm card requires returning to the PCM 80's internal memory by loading a preset or register from one of the internal banks. Otherwise, the following error message will be displayed when you press **Load/★**:



To load a different algorithm card :

1. Press **Program Banks** and select an internal preset bank (**P0 - P3**).
2. Turn **SELECT** to display any preset in any of these banks, then press **Load/★**.
3. The new algorithm card can now be loaded as described above.

Once extension card software is loaded, you can remove the card from the slot. The algorithms will remain in the PCM 80 until the unit is turned off, or a new algorithm card is loaded. This makes the PCMCIA card slot available for loading and storing registers on RAM cards.

Loading the Vocal Fix Presets

Once the software is loaded, the PCM 80 will have access to the program bank on the algorithm card. This extension memory banks is labeled with an **X**.

1. Press **Program Banks** repeatedly until the **X** bank is displayed. This will follow all of the PCM 80's internal Program banks.
2. Use SELECT and **Load/★** to view and load the Vocal Fix presets.

You can edit these presets and save the changed version into the PCM 80's internal registers, or you can save them into RAM card register banks. If the Vocal Fix algorithm is loaded, recalling programs created with the algorithm is as simple as selecting and loading any PCM 80 program.

If the Vocal Fix algorithm is not loaded when you attempt to load a program created with it, the display will indicate that the selected register requires extension memory (in this case, the Vocal Fix card).



The Pitch Correct Algorithm and Its Parameters

Overview

Digital pitch shifting requires temporal compression or expansion of audio data and the addition or removal of small audio segments to compensate. Raising pitch is accomplished by compressing the audio data — making it run faster. As this shortens the audio segment, a copy of a section of the audio being processed is added to fill out the remaining time. To lower the pitch, the signal is expanded, requiring the removal of a section of the audio. These operations are performed repeatedly at high speed, at intervals which vary according to the type of audio signal being processed.

At each point where audio is added or removed, the audio signal must be rejoined, or spliced. If added or removed segments were perfectly correlated with the remaining audio, splicing would be seamless. In reality, these splice points are the source of audible artifacts which can be minimized, but not completely eliminated.

Much of the art of pitch shifting, therefore, is in determining the appropriate intervals for sampling and the optimal points for splicing. As the PCM 80 Vocal Fix card gives you significant control over these operations, you may find it helpful to keep in mind some of the other factors which can affect pitch shift quality:

- **Amount of pitch shifting**
Large shift intervals require more splicing. As each splice can be the source of an artifact, increasing their number increases the likelihood of audible artifacts.
- **Pitch-complexity of the input material**
Pure tones have simple waveforms which can be correlated easily for smooth splicing. Pitch shifting of simple tones such as those generated by a solo voice or a monophonic instrument generally produces fewer artifacts than pitch shifting of wide bandwidth material such as piano chords, full orchestra, etc.
- **Low frequency content of the input material**
Pitch shifting low frequency material requires the addition or removal of larger segments of audio than high frequency material. The increased size of these segments can introduce delays which are heard as artifacts.
- **Transient content of the input material**
When large amounts of pitch shifting are applied to complex input material with dense percussive transients (drums, strummed mandolin, complex speech, etc.) some of the transients may lose definition or be shifted slightly in time.

Intelligent pitch involves two major tasks, pitch detection and pitch shifting. Pitch detection requires analyzing the input signal to determine its pitch – notes from a chromatic scale: A, B, E-flat, etc. The second task involves shifting the pitch of the input signal to a different note. The “intelligent” part refers to the ability of the algorithm to follow a set of rules to determine an appropriate output pitch based on the detected input shift.

The Vocal Fix Pitch Correct algorithm is designed to work with monophonic (one note at a time) vocal sources. The algorithm contains an intelligent pitch shifter combined with a PCM 80 Chamber reverb. The intelligent pitch shifter detects the pitch of incoming audio and produces effects based on the detected pitch.

The reverb follows the pitch shifter in series. The FX Mix parameter is set to 0% reverb as most applications require only pitch processing.

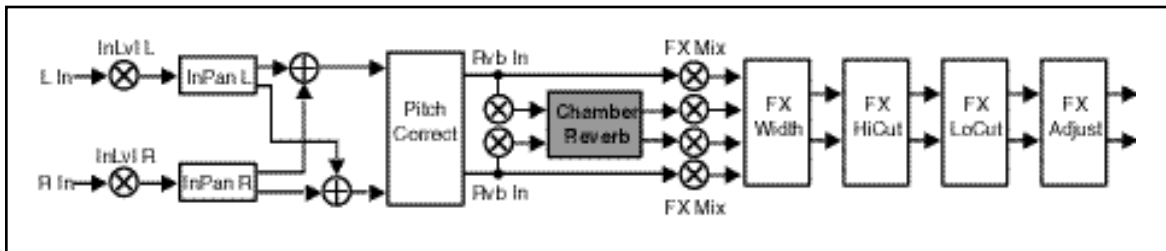
The following pages contain diagrams of the reverb and the pitch shifting portions of the Pitch Correct algorithm, along with a complete parameter matrix and descriptions of the Pitch Correct parameters. Refer to the PCM 80 User Guide for detailed descriptions of all other effect parameters.

The PitchCorrect Algorithm

The Pitch Correct algorithm provides a simple, yet powerful, set of tools for correction of previously recorded melody tracks which are off pitch. The Pitch Detect display shows the pitch of the input source in real time, displayed as a chromatic note and \pm cents so that you can see exactly where and how much correction is needed. For most applications correction will only be needed for notes that are audibly sour.

There are two basic approaches to this type of pitch correction. The first is to patch the Correct parameter to a switch or to the ADJUST knob, the second is to use a MIDI keyboard to control correction. The patch method is preferable for fine tuning a performance, whereas using a MIDI keyboard provides more flexibility when handling more serious pitch errors, or when it is necessary to completely rework the melody.

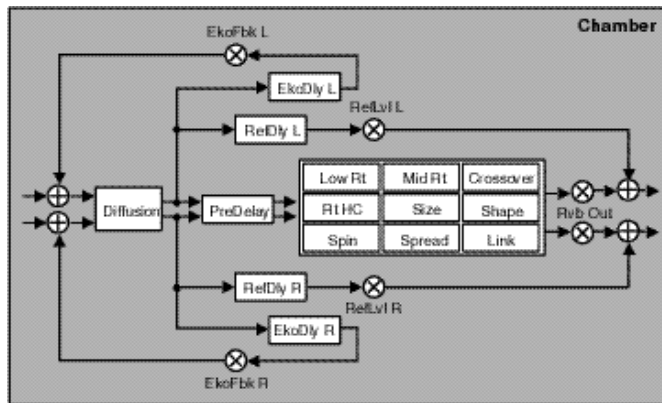
MIDI control is straightforward. Just connect a MIDI keyboard to the PCM 80 MIDI IN jack, set the keyboard and the PCM 80 to the same MIDI channel, and you're ready to start. Don't try to play the melody note-for-note — just [ress the keys needed to correct bad notes. When you press a key on the MIDI keyboard, the audio is forced to the keyboard's pitch. When you release the key, the audio is processed according to the settings you have made to Correct and Tracking. Typically, Correct will be set to 0% and Tracking set to Fastest. This results in the MIDI note determining the correct pitch and triggering correction on and off. (By the way, you don't need a score to know which note, just watch the Pitch Detect display.)



0	Controls	0.0 Mix	0.1 LatAdjust	0.2 *Invl L/R	0.3 FX Mix	0.4 *FX Hi/LaCut	0.5 FX Width	0.6 *La/Hi Limit						
1	Reverb Time	1.0 Low Rt	1.1 Mid Rt	1.2 Crossover	1.3 Rt HC	1.4 Pre Delay	1.5 *Revl L/R Dly	1.6 *Eko Fbk Dly						
2	Reverb Design	2.0 Size	2.1 Diffusion	2.2 Shape	2.3 Spread	2.4 Spin	2.5 Link	2.6 *Revl Out/In						
3	Pitch	3.0 Detect	3.1 Correl	3.2 GlidResp	3.3 Tracking	3.4 Low Pitch	3.5 High Pitch	3.6 Tuning	3.7 Splice					
4	Shift	4.0 Gerts	4.1 Scent ones											
5	Modulation	5.0 *Mod LFO	5.1 *Mod AR Env	5.2 Mod Env L	5.3 Mod Env R	5.4 *Mod Latch	5.5 *Mod Str 1	5.6 *Mod Str 2						
	Patches	Patch 0	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5	Patch 6	Patch 7	Patch 8	Patch 9			

The Chamber reverb produces an even, relatively dimensionless reverberation, with little change in color as the sound decays. The initial diffusion is similar to the Concert Hall algorithm, but the sense of space and size is much less obvious. This characteristic, along with the low color in the decay tail, makes Chamber useful on a wide range of material. It is especially useful on spoken voice, giving a noticeable increase in loudness with very low coloration.

The Chamber Reverb



Parameter Descriptions

Controls Row **FX HiCut, FX LoCut**

These parameters control stereo high cut and low cut filters on the algorithm outputs. Each has a range of 20Hz- 20kHz.

Pitch Row **Detect**

This parameter displays the source used for pitch detection: Input, Fixed or MIDI.

Input	Pitch is detected from the sum of the left and right input signals. The detected pitch and the number of cents sharp or flat is displayed and updated in real time.
Fixed	ADJUST scrolls through the range of available pitches. The number of cents sharp or flat from the selected fixed pitch is displayed and updated in real time.
MIDI	This setting is displayed when you use a MIDI keyboard as the note detect source. Connect a MIDI keyboard to PCM 80 rear panel MIDI IN jack and set both to the same MIDI channel. Whenever a preset that uses the PitchCorrect algorithm is running, the shifter will detect the pitch of any MIDI key you press. The display will show the MIDI pitch and the number of cents sharp or flat in real time as the pitch of the input signal varies. Correct the pitch of any melody by simply playing the appropriate MIDI key when ever the melody pitch drifts from the desired note.

Correction

This parameter lets you control the amount of off-pitch correction (0-100%) applied. When set to 0, no correction is applied. When set to 100%, notes are shifted as close as possible to the frequency of the detected pitch (or to the frequency of harmonies of the detected pitch).

GldResp

This parameter is similar to the GldResp parameter found in the Master Delay parameter of several PCM 80 delay and reverb algorithms. It sets the pitch shifter's responsiveness to the pitch detect source and also to modulation by internal controllers (LFO, AR etc.) and MIDI controllers (aftertouch, velocity, etc.) At the highest setting (100), the pitch will track the detect source very closely. At lower settings, the pitch will lag behind the modulation source. A setting of about 50 generally yields good results for tracking vocals.

Tracking

This parameter controls how quickly (accurately) the pitch detector will follow pitch changes in the detect source. This control can be set to Fastest, Fast, Moderate, Slow or Hold.

Fastest This is generally the most useful setting as it provides accurate tracking as well as good handling of vibrato or pitch bends.

Fast, Moderate and Slow These settings are useful for special effects.

Hold This setting freezes at the last detected pitch, effectively turning any melody into a pedal tone.

Low Pitch and High Pitch

These controls allow you to set a range of pitches to be detected. This is very useful with source material that has extraneous noise, for example, a vocal track which contains some headphone leakage picked up by the vocal mike. If Low and High Pitch are set to bracket only the vocal frequencies, there will be no glitches caused by the shifter detecting headphone material outside the vocal range.

Note that Low Pitch also affects the amount of time that the pitch shifted material is delayed. At the lowest setting, the amount of delay is about 60ms. At the highest setting it is about 20ms.

For reference, a list of the lowest and highest pitches of some typical sources is shown below.

vocal: bass	Eb2 - -Eb4
vocal: baritone	Ab2 - -Ab4
vocal: tenor	C3 - -C5
vocal: alto	F3 - -F5
vocal: soprano	C4 - -C6

Tuning

This parameter allows you to set a reference frequency for the pitch, "A". The range is from 410.0-470.0Hz. The standard reference frequency is 440.0Hz.

Splice

This parameter allows you to change the amount of time used to crossfade the splices that occur whenever pitch is shifted. A value of 8ms is appropriate for most material. Higher values will produce longer/smoothier cross-fades, but the intelligibility of transients and high frequency content may be affected. Lower values will reproduce transients more accurately and have more high frequency content, but the splices may be more audible.

Shift Row Shift Cents

This parameter determines the amount of fixed shift for the stereo input channels. The value is given in cents (1 cent=1/100th of a semitone, 1200 cents/octave). The range is adjustable in increments of a single cent. This value can be modulated smoothly with patch sources to create vibrato and other pitch-related special effects.

Shift Semitones

This parameter provides ± 1 octave of pitch shift in half-step (chromatic) intervals.

Note: As the Cents and Semitones controls are additive, it is possible to shift tones by as much as ± 2 octaves.

Using the Vocal Fix Programs

Without the Vocal Fix algorithm, pitch correction can be a very “hit or miss” process. Typically, a MIDI Mod wheel or Pitch Bender is used to control a pitch shifter and corrections are made on the fly by moving the wheel and listening to the pitch. This trial and error procedure can be very frustrating and often requires going over the same material again and again.

Some pitch shifters have a “correction” feature which forces the pitches of the vocal track to the nearest semitone (e.g. a slightly flat “F” is corrected to a perfect “F”). In theory, this would allow you to turn on the pitch corrector and have your track fixed automatically. In reality, there are several problems with using correction this way:

First, even the best vocal performances are not “perfect.” A good singer uses vibrato, and other expressive techniques that modulate or glide the pitch. Automatic correction will try to “fix” these pitch variations and the result will sound unnatural.

Second, as virtually all pitch shifting processes create audible artifacts, **the best results are achieved by applying correction *only where necessary*.**

Third, there are times when you need to fix a note that is completely wrong, not one that’s just a little sharp or flat. The note sung might be an E, for example, when it should actually be a D. Since correction works by pushing the note to the nearest semitone, there’s no way to select a different note.

The Pitch Correct algorithm lets you select the most suitable method for the area of the track you are working with, and apply the most effective correction process for your material.

In general, the track with errors is routed through the PCM 80, processed by one of the Vocal Fix presets and re-recorded. Depending on the number and type of errors on a given track, it is possible to fix the vocals in one pass. Typically, however, you may need to make several passes, fixing a particular note or phrase in each pass.

Running the track through the pitch shifter adds a slight delay. The amount of delay is dependent on the setting of the low note parameter. (See the table to the right.) If necessary, you can align the fixed track with the original by either slipping the fixed track ahead, or all of the original tracks behind.

General Procedure

Low Pitch	approx. delay (in ms)	Samples	
		44.1k	48k
A0	82	3616	3936
B0	74	3263	3552
C1	71	3131	3408
D1	64	2822	3072
E1	58	2557	2784
F1	56	2469	2688
G1	51	2249	2448
A1	46	2028	2208
B1	42	1852	2016
C2	40	1764	1920
D2	37	1631	1776
Eb2	35	1543	1680
E2	34	1499	1632
F2	33	1455	1584
G2 and above	30	1323	1440

Preset Descriptions

Vocal Fix (X0 0.0-0.9)

With the exception of Demo Correct (0.9), all of the presets are designed to accept a mono vocal track on either (or both) inputs. Note also that, in each preset, the reverb is turned off and all pitch parameters that are not patched can be found in the Soft Row.

- | | | | | |
|------------|--|----------------|---------------|--------------|
| 0.0 | VoxFix E2>C6 | ADJUST: | On/Off | 0-1 |
| | This preset is set up to be used with a MIDI controller with a keyboard, pitch bender and sustain pedal. It provides three different methods to correct pitch problems. You can: use the bender to change the pitch "on the fly," use the sustain pedal to turn correction on and off, or fix a bad note by playing the correct one on the keyboard. Press Edit to see the notes displayed. ADJUST is patched to turn correction on and off. All of the pitch parameters that aren't patched are in the Soft Row. Low Note and High Note are tuned to the full vocal range (E2 through C6). | | | |
| 0.1 | VoxFix Bass | ADJUST: | On/Off | 0-1 |
| | The same as VoxFix E2>C6, except that it is tuned to the bass range (E2-A4). | | | |
| 0.2 | VoxFix Tenor | ADJUST: | On/Off | 0-1 |
| | The same as VoxFix E2>C6, except that it is tuned to the tenor range (C3-C5). | | | |
| 0.3 | VoxFix Alto | ADJUST: | On/Off | 0-1 |
| | The same as VoxFix E2>C6, except that it is tuned to the alto range (F3-F5). | | | |
| 0.4 | VoxFix Sprno | ADJUST: | On/Off | 0-1 |
| | The same as VoxFix E2>C6, except that it is tuned to the soprano range (C4-C6). | | | |
| 0.5 | KnobCentsUp | ADJUST: | Sharp | 0-100 |
| | For tracks that are consistently flat. Use ADJUST to tune the track up, and a MIDI keyboard to fix bad notes. | | | |
| 0.6 | KnobCentsDN | ADJUST: | Flat | 0-100 |
| | For tracks that are consistently sharp. Use ADJUST to tune the track down, and a MIDI keyboard to fix bad notes. | | | |
| 0.7 | Double Effect | ADJUST: | On/Off | 0-1 |
| | This preset produces an alternative double track effect. Mix the output of the PCM 80 with the original vocal track. Use ADJUST to randomize the amount of delay and pitch difference between the original and processed tracks. | | | |
| 0.8 | Knob Freeze | ADJUST: | On/Off | 0-1 |
| | This one is a special effect. Turn ADJUST from 0 to 1 to freeze the pitch of the vocal track to whatever was being sung when the knob was turned. Turn it back down to 0 to release the pitch. Mixed with the original, this creates drone-like harmonies. By itself, this effect is a new take on "robot" voices. | | | |
| 0.9 | Demo Correct | ADJUST: | unused | |
| | This preset is for demonstration use. The left input is turned off and all the pitch parameters are in the Soft Row. | | | |

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