

Instructions for using the AX80 Rev I2, K2 and L2 Firmware

R Grieb, Nov 2016

PLEASE READ CAREFULLY BEFORE INSTALLING!

The new operating software is in the form of a binary executable of 8 Kbytes. It can be programmed either in a 2764 EPROM, or in the top ¼ (offset of 6000h) of a 27C256 EPROM or 27256. There are currently three versions of the new code: Revs I2, K2 and L2. Akai released three versions of the code for the AX80: I, K, and L. The only differences were the changes made due to changes to the CEM3372 chip. Each rev of the code works best with a particular rev of the 3372. This is explained in the AX80 service manual. Please check it if you are unsure which version you should be using. There is no need to get “the latest” code in this case.

The original firmware remains the property of Akai. The additional code is the property of the authors, Bob Grieb and my collaborator, who wishes to remain anonymous. The program cannot be used in whole or in part for commercial purposes.

The firmware is written in NEC uPD7810/11 assembly language and assembled with AS. Our intent was to preserve all features of the original code. New code has been written to take as few CPU cycles as possible and not affect response times.

Note: This firmware is currently in the “Beta” test state and may contain bugs. Please report any unusual behavior so that we can make this as solid as possible before making it available to a wider audience. New feature requests are not being sought, as the EPROM is pretty much full.

Note: Before you first power up your AX80 with the new EPROM installed, please back up any RAM programs that you would not want to lose. Also, place the rear panel Memory Protect switch in the On position. This inhibits all writes to one of the two RAM chips. In case there was some issue with the EPROM programming, or a pin is bent under the chip and not actually in the socket and the CPU crashes, if Protect is on, all A bank programs and about half of the B bank ones will be safe. Once you have everything up and running, put the switch wherever you like. This switch does not affect saving or updating NVRAM settings.

Some small changes have been made, and several new features have been added:

SYSEX Patch save and restore:

It is now possible to save and restore all 64 Bank A and B patches using MIDI. To save, press Tape, then 30 (Save). If you press Save a second time, the patches will be sent to the cassette interface, as before. Reception does not require any special button pushes. The patches are sent as 64 complete units, each with a header, a program number and the sysex end byte. The format is as follows:

F0 47 7E pp dd dd dd ... F7 Since the program number (0-63) and all parameter values fit in seven bits, there was no need to split the data into low and high nibbles for MIDI. The dd bytes contain the parameter values for a patch, starting with 1, then 2, etc. up to parameter 45.

Non-volatile RAM variables:

The AX80 stores patches in battery-backed SRAM. We have added non-volatile (NV) storage of several values. MIDI transmit and receive channels are now saved in NVRAM. Also, a copy of the current program selection is maintained, and is restored on power up. Lastly, a new variable called NVLFOFR is maintained.

Free-Running LFO mode:

In the Akai firmware, all three AX80 LFO's were reset on every key press or MIDI note assignment. We have added a way to enable or disable this resetting. (The selection is stored in NVLFOFR, mentioned above) The default value of this variable, set when you first install the new code, will disable resetting the LFO's, causing them to free-run. (The LFO delay function is not affected) To change the setting, press the Tape switch, then press 1 to disable free-running (dF is shown) or 2 to enable it (EF is shown). Hit Tape again to exit tape mode. This setting is saved in battery-backed SRAM.

Note: Some of the factory presets seem to have an LFO modulating DCO2 with a very low frequency ramp waveform. In the original firmware, since the LFO's were reset by the key press, they would be at low amplitude and not affect the DCO2 pitch much. If LFO reset is disabled, the LFO's will free-run, so the amount of pitch change will vary from one key press to the next, and can make these presets sound "out of tune", as one person noticed recently. This is sort of an incompatibility between some factory presets and the free-running LFO mode. Preset 8 is a good example.

VCF cutoff parameter updating:

The Akai code used the VCF cutoff setting whenever a key was pressed or a MIDI note was assigned. Any change to the parameter after that would not take effect until a new key was pressed or a note assigned. The code has been changed to apply the VCF cutoff parameter at the same time as the LFO and EG values are computed, which is happening constantly. So VCF cutoff parameter changes now take effect immediately.

MIDI channel setting displays:

When the MIDI channels are being set, you will now see rC. (receive channel) and SC. (send channel) on the left display.

Current program display when patch write initiated:

After editing a program, if you wanted to write it back, you could not see the number of the current program. Now, when you press Write to save an edited program, the current program number is displayed on the data display. This may seem a little odd, but will hopefully be useful. The bank is shown using the data display right digit's decimal point. If the current bank is B, it will be illuminated.

MIDI Sysex and CC parameter updates:

It is now possible to change parameter values using MIDI sysex strings or continuous controller messages. Using sysex, the hex format is:

```
F0 47 7E 40 pp vv F7
```

The pp byte is the number of the parameter to be controlled, added to 64 decimal. Parameter numbers start at 1 to match the Akai front panel and owner's manual. So the first pp value would be 65 decimal, or 41h. The vv byte is the value of the parameter. Values should, in general, match the ranges shown in the owner's manual, but there are some exceptions:

For parameter 1, a value of 0 selects 16', 1 is 8' and 2 is 4'.

For parameter 7, the mapping is:

0-11: 16/0-11, 12-23:8/0-11, 24-35:4/0-11, 36-47:2/0-11 So they are showing the interval between DCO2 and DCO1 as an octave and a semitone step within that octave. Values for this parameter range from 0-47 (decimal)

For parameter 12, a value of 0 selects EG 1 and a value of 1 selects EG 2.

For parameter 23, values of 0-3 map to selections 1-4 as shown in the manual

For parameter 24, values of 0-2 map to selections 1-3 as shown in the manual

For parameter 30, values of 0-2 map to selections 1-3 as shown in the manual

CC format is Bn pp vv, where n is the MIDI receive channel and pp and vv are the same as for sysex.

For either type of parameter update, the Edit LED will light, the parameter number and value will be displayed, and the VFD display will also be updated. When editing the LFO or EG parameters, if the one being edited is not currently selected for display, the bar graph won't change. To see any changes to LFO1, you need to select LFO1 for display in the LFO section first. You can do this with a MIDI parameter 24 command, or by using the front panel. There isn't enough space left in the EPROM for the code to do this automatically. Ideally, any controller would always send a parameter 24 command to select the correct LFO for display right before it sent the LFO parameter update command.

I would like to thank my mystery collaborator, who wishes to remain anonymous, for his ideas, his help, and his code.