

Poly Evolver Keyboard (PEK) Tech Notes

General System Notes:

- In the PEK, the middle panel PCB functions as the “Main Board”. This is where the general housekeeping MCU (dsPIC30f6011) resides. The Main operating system is stored in non-volatile memory within the Main MCU. The Main MCU scans the pots/switches and keyboard, drives the LEDs and the display, handles MIDI and other peripherals (expression pedal and footswitch inputs), and communicates bidirectionally with the Voice MCUs via an external UART IC (TL16C554PN).
- The Voice board is mounted to the bottom metalwork. The Voice board is comprised of four duplicate blocks of circuitry, each with its own digital and analog subsystem. The Voice MCU (PIC18F452-I/P) performs a multitude of tasks in both domains, including but not limited to the following:
 - Generating the control voltages for the analog portions of the voice (via a standard DAC / S&H circuit)
 - Generating the DCO clocks
 - Resetting and Communicating with the DSP

The Voice operating system is stored in memory within the Voice MCU. The DSP (ADSP-2191) operating system (i.e. the instruction set) is stored in an external flash memory IC (AT29LV020-20JC).

Shortcuts/Key Combos:

- To reset the Global parameters, hold RESET in the sequencer section, and press “0” on the numeric keypad.
- To display the currently installed OS versions, hold RESET in the sequencer section, and press “1” on the numeric keypad.
 - NOTE: The Voice OS and DSP OS are polled from Voice 1 only. Generally speaking, if the Voice OS and DSP OS display as expected, then the Voice MCU and DSP flash IC have been programmed correctly and the ICs are making good electrical contact with their sockets. Swapping ICs from other voices into the Voice 1 sockets and verifying them with the display OS command can be helpful when troubleshooting.
- To calibrate the analog oscillators and filters, hold RESET in the sequencer section, and press “2” on the numeric keypad. If a voice does not pass calibration, the display will halt on the stage that fails. This is helpful when pinpointing the fault. A calibration failure does not necessarily indicate that the fault is in the analog subsystem. A failed Voice MCU or audio CODEC, for example, would cause calibration to fail.

Wheel Calibration instructions for the PEK

1. Hold the both the pitch and mod wheel in the LOW position with your left hand. Then, with your right hand hold RESET and press 4 on the numeric keypad.
2. Remove your left hand so that the pitch wheel returns to CENTER and the mod wheel stays LOW. Then, with your right hand hold RESET and press 5 on the numeric keypad.
3. Hold the both the pitch and mod wheel in the HIGH position with your left hand. Then, with your right hand hold RESET and press 6 on the numeric keypad.

Common Faults and Troubleshooting:

Socketed IC's – On most versions of the Voice board, both the Voice MCU and the DSP flash IC are socketed. These sockets can develop intermittent contacts. Sometimes simply removing/reseating the chip is an effective fix. Removing the PLCC sockets and soldering directly to the PCB is a more durable option. Later versions of the Voice board shipped with the Voice MCU soldered to the PCB, though the DSP flash was still socketed.

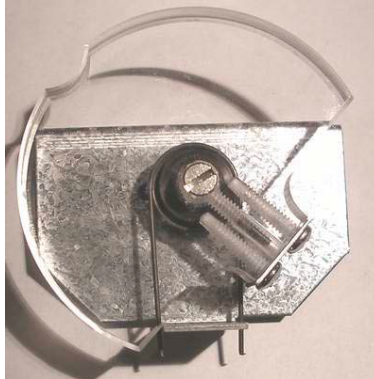
Blown UART – It is possible for the UART IC to fail if the Voice Board to Middle Panel Board connector is installed with one end of the cable in reverse orientation to the other end. Take care when installing this cable. Note the orientation if this cable must be removed during service.

Failed CODEC – The Analog Devices AD1836AAS CODEC runs quite hot in this design. They fail on occasion and must be replaced. The IC is obsolete and Sequential has no spare stock remaining. We have also depleted our stock of scrap PCBs to harvest this part from.

Failed DSP – The Analog Devices ADSP-2191 also fails on occasion. The IC is obsolete and Sequential has no spare stock remaining. We have also depleted our stock of scrap PCBs to harvest this part from.

Wheel pot alignment – If the pots in the pitch/mod wheels are not properly aligned, it can wreak havoc in unexpected ways. The PEK wheels are the same as those used in the Moog Voyager. Dave purchased these wheels directly from Bob Moog.

- 1) With a screwdriver, turn the pot shaft counter-clockwise until it stops.
- 2) Rotate the wheel fully counter-clockwise until rests on the bracket.
- 3) While holding the wheel so it doesn't move, turn the pot shaft clockwise a small amount; the shaft should be at roughly 2:00/8:00 o'clock.
- 4) Without moving the wheel or the pot shaft, tighten the set screw in the wheel firmly on the pot shaft.



LCD Backlight – Early units used a 68 ohm current limiting resistor (R4 on the middle panel PCB) on the backlight LED in the LCD. The backlight LED was prone to burning out, and eventually R5 was changed to 100 ohms in production. If the backlight LED has burned out, it's easier to replace the LED than the entire backlight assembly. It's possible to snip the leads and remove the LED from the backlight assembly (some force is required). Then, a replacement LED can be positioned and soldered into place. It's necessary to remove the 3-digit segment display to gain access to the backlight LED. The segment display is conveniently socketed.

Old Encoders – The PEK was sold with two versions of front panel hardware. The instrument was first released with panel PCBs constructed entirely with rotary encoders for the front panel controls (save for Master Volume, which was a potentiometer). For the first few years of production, the part used was a non-detented (spins smoothly) encoder that ended up having a much shorter lifespan in the field than was anticipated. This led to the introduction of the PE (potentiometer edition) version of the instrument, which featured panel PCBs constructed mostly of potentiometers, with some detented rotary encoders made by ALPS. We continued to sell the encoder version of the instrument as well, but the original non-detented encoders were replaced by the ALPS detented part.

In addition to spinning smoothly, the original non-detented encoder can be identified visually by a gray plastic shaft. The replacement ALPS detented encoders has a black plastic shaft. The part number is ALPS EC12E2420801.

Any unit that is fitted with the original non-detented encoders should have every encoder replaced with the ALPS detented part. There is no other solution.

Power Supply Issues – There are three switching regulator ICs on the Voice board which did not have their thermal pads soldered in production, despite there being an exposed pad on the PCB. If there was an explanation for this, it's lost to time, but I've repaired many PERs which exhibited mysterious faults simply by removing these ICs and reworking them with the thermal pad soldered. The three switchers are all Analog Devices LT1767: one with user configurable output voltage (U6, 7V), and two with fixed output voltages (U6, 5V & U4, 2.5V). Don't mistake them for being interchangeable, despite their size. The identifying marks on the IC packages are similar but not identical.

Programming Procedures:

The Main and Voice operating systems are programmed using a Microchip programmer/debugger and the Microchip Integrated Programming Environment (IPE) software application. There are many 3rd party programmer tools available, though the Microchip ICD3 is the only tool used at Sequential HQ and known unequivocally to work. The ICD3 connects to the PCBs via RJ45 connector. Both the Main and Voice MCUs require configuration bits to be set properly. Failing to set the config bits prior to programming will render the MCUs inoperable (this condition is not permanent and can be re-attempted with the correct parameters).

The config bits are noted below.

Main OS (Microchip dsPIC30f6011):

- Clock Switching and Monitor: SW Disabled, Mon Disabled
- Oscillator Source: Primary Oscillator
- Primary Oscillator Mode: XT w/PLL 16x
- Watchdog Timer: Disabled
- WDT Prescaler A: 1:512
- WDT Prescaler B: 1:16
- Master Clear Enable: Enabled
- PBOR Enable: Enabled
- Brown Out Voltage: 2.7V
- POR Timer Value: 64ms
- General Code Segment Code Protect: Disabled
- General Code Segment Write Protect: Disabled
- Comm Channel Select Use: PGC/EMUC and PGD/EMUD

Voice OS (Microchip PIC18F452-I/P)

- Oscillator System Clock Switch: Disabled
- Oscillator Selection: HS Oscillator with PLL enabled (Clock = 4 x Fosc)
- Brown Out Reset Voltage: 2.7 Volts
- Brown Out Reset: Enabled
- Power Up Timer: Enabled
- Watchdog Timer Postscale: 1:128
- Watchdog Timer: Disabled
- CCP2 Mux: Multiplexed with RC1
- Stack Overflow/Underflow Reset: Enabled
- Background Debugger: Disabled
- Low Voltage Programming: Disabled
- All Code Protection: OFF (not protected)
- Table Read and Write Protection: OFF (no protection)

DSP OS:

The DSP OS is programmed directly into the flash memory IC (Atmel AT29LV020-20JC). This can be accomplished using an IC programmer such as the inexpensive GQ-4X from MCUmall.com, provided that you have a PLCC32 adapter. There are no extra steps beyond flashing the binary file to the IC.

Note: The system will not function properly with mixed operating system revisions. The last production revision binaries for the Main/Voice/DSP operating systems are compatible with all versions of the hardware, and are provided with this service packet. When programming the Voice and DSP operating systems from the binaries as described above, the procedures must be repeated for each block of voice circuitry.

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