

## Poly Evolver Rack (PER) Tech Notes

### **General System Notes:**

- In the PER, the Main operating system is stored in non-volatile memory within the Main MCU (PIC18F452-I/P). The Main MCU scans the front panel controls, 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). For the voices there are four duplicate blocks of circuitry, each with its own digital and analog subsystem. The Voice MCU (also 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 display the currently installed OS versions, hold RESET and press COMPARE on the front panel.

- 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 and press GLOBAL on the front panel. 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.

## **Common Faults and Troubleshooting:**

Socketed IC's – On some versions of the Main board, both the Main and Voice MCUs are socketed, and the DSP flash ICs are socketed. These sockets can develop intermittent contacts. Sometimes simply removing/reseating the chip is an effective fix. Later versions of the Voice board shipped with the Voice MCU soldered to the PCB, though the DSP flash was still socketed.

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.

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 PEKs 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 (U99, 7V), and two with fixed output voltages (U6, 5V & U3, 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 first (and most common) version of the Main PCB utilizes PLCC sockets for the Main and Voice MCUs. This version does not provide facilities for in-circuit programming. The MCU ICs must be removed and programmed externally. The GQ-4X from MCUmall.com is an inexpensive option for this task. A PLCC44 adapter is required. 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).

An updated version of the Main PCB was deployed for the final production run of PER units. In this version, the Main and Voice MCUs are soldered directly to the PCB. Pin headers are provided to program these ICs in-circuit using a Microchip programmer/debugger and the Microchip Integrated Programming Environment (IPE) software application. There are many 3<sup>rd</sup> 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 PCB pin headers. 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 and 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.

**Post Script:** The above statement has a caveat. A hex file for programming Main OS 2.0 is provided, but there was a Main 2.1 released eventually. We cannot find a hex file for Main 2.1. So, use the 2.0 hex to update manually to 2.0, and then use sysex to update to 2.1.

Andy Lambert  
Senior Engineering Technician  
andy@sequential.com