Instructions for using the Prophet 5 Rev 3.3 V10.6 Firmware

PLEASE READ CAREFULLY BEFORE DOWNLOADING!

The program available here for downloading is in the form of a binary executable of 8 Kbytes. It has been divided into two 4K pieces, for programming into two 2732 EPROM chips. (The original ones were -3 300nSec access time NMOS parts.) It contains a modified version of the original SCI firmware Rev 10.5 plus added code.   There is a photo at the end of this document which shows the EPROMs on the pcb, and their orientation.

The original SCI firmware remains the property of Yamaha or whoever might currently own the rights to SCI code.

The additional code is the property of the author, Bob Grieb. The program cannot be used in whole or in part for commercial purposes.

The firmware is written in Zilog Z80 assembly language and assembled with TASM32. My intent was to preserve all features of the original code, including Scale Mode, and the cleansing mantra which is traversed at the start of each main loop execution. New code has been written to take as few cycles as possible and not affect response times.

Note: Before you first power up your Prophet with the new EPROMs installed, please place the rear panel Enable/Disable switch in the down (disable) position.   This inhibits all writes to NVRAM. In case there was some issue with the EPROM programming, or a pin is bent under the chip in the socket, or something, and the CPU crashes, if the switch is down, your programs will be safe in NVRAM.   Once you have everything up and running, move the switch up to enable writing to NVRAM, so that your MIDI settings can be saved.

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

Tuning progress display:

The program LED's now show the progress of the tuning algorithm as it calibrates each oscillator of each voice.   LED's 1-5 show the current voice, and LED's 7 and 8 show the oscillator A or B selection.   Since tuning starts with the values in RAM, the time required will vary depending on how current those values are. After tuning completes, any voices/oscillators which fail to tune are indicated by flashing the LEDs for each one, in sequence. Failing voices are NOT automatically disabled, but this can be done manually. Note that there is a fair amount of circuitry in each voice after the point that is sampled for oscillator tuning, so a voice can pass tuning and still have problems.

Sysex:

When sending a program dump over MIDI, the V10.5 code did not send the final "0F7" MIDI "End of System Exclusive" byte.   The V10.6 code sends this byte.

Pressing "Record" plus 7 (previously unused) now sends a sysex containing all 120 programs in order. Each program is sent in the same format used when only one program is sent, including the 0F7 termination.

The size of this transmission is 6360 bytes.   The existing Prophet code can load all 120 programs if this file is sent back to it.

Front Panel MIDI Selections:

The settings which are changed by holding "Record" plus a program switch are now saved in non-volatile RAM and are preserved when power is switched off. A new setting has been added.   Here are the settings:

Record + 1: Program change enable/disable, default= enable **(setting now NV)** LED 1 on when Record pressed means it's enabled.

Record + 2: Dump current program **(with 0F7 byte added)**

Record + 3: Pitch wheel receive wide **(setting now NV)**

Record + 4: Pitch wheel receive medium, default **(setting now NV)**

Record + 3 + 4: Pitch wheel narrow **(setting now NV)**

Record + 5: Program data MIDI sysex receive enable (default)/disable **(new NV setting)**   LED 5 on when Record pressed means it's enabled.

Record + 6: Omni on/off, default = off **(setting now NV)**   LED 6 on when Record pressed indicates Poly mode.

Record + 7: Dump all 120 programs (with 0F7 bytes added)   **(New feature)**

Record + 1 + 8: MIDI voice disable (1+8 is normal voice disable, NOT NV)

Record + 8: Used to set MIDI channel.   **(MIDI channel is now saved in NV RAM)**

New Program Switch Combinations to set mode:

Several new modes/features have been added which can be enabled or disabled by pressing combinations of program switches: (These settings are saved when power is off) It is best to disable Preset mode when changing settings, to avoid changing the selected program.

Pressing 1 + 2: Disables voice activity display.   Program LEDs used as in original code.

Pressing 1 + 3: Enables voice activity display on Program LEDs 1-5 (except when Record switch is pressed)

Pressing 1 + 4: Sets "Unison 1" mode number of voices to 1.   The first non-disabled voice is used.

Pressing 1 + 5: Sets "Unison 1" mode number of voices to 2. The first two non-disabled voices are used.

Pressing 1 + 6: Disables reassigning Oscillator B Fine pot to "Unison detune".   Unison detune feature is disabled.

Pressing 1 + 7: Enables reassigning Oscillator B Fine pot to "Unison detune" if either Unison mode is enabled. Oscillator B Fine setting is zero in this mode.   Since Oscillator B Fine setting is saved in the program, the Unison detune value is saved.

Unison Detune:

If enabled (see above) when in either Unison mode, the Oscillator B Fine control can be used to add a variable amount of detune to four of the voices.   A value based on the control setting is added to the pitch of both oscillators of voice 2.   The same value is subtracted from both oscillators of voice 3.   Twice this value is added to both oscillators of voice 4, and subtracted from both oscillators of voice 5.   Since detune is added symmetrically, the perceived pitch of the note played doesn't change.   Voice 1's oscillators are not detuned.

"Uni1" mode:

Pressing the Unison switch now causes it to cycle through three states, instead of simply on/off.   The sequence is: Off/Normal Unison/Uni1/Off   In normal Unison mode, the Unison switch LED will be on steadily. In this mode, all five voices will be used, and detune can be applied and adjusted using Oscillator B Fine, if desired, by enabling it as described above.   In "Uni1" mode, the Unison switch LED will flash.   In this mode, either one or two voices (a global NV setting) will be used.   Key assignment is different in the two modes.   In single-voice Uni1 mode, "last note priority" is used.   In two-voice Uni1 mode, or in normal Unison mode, "low note priority" is used.

Unison or Uni1 selection is stored with each program.   Whether Uni1 uses one voice or two is a global NV setting, and is not stored with each program.

Note: Unison detune does not affect voice 1.   If Uni1 mode is selected and is using only voice 1, detune will have no effect.

Note: Uni1 mode will use the first or the first two voices it finds that have not been disabled by the user. If you disable voice 1, then it will use voice 2, or voices 2 and 3.   If all five voices are disabled, and a key is pressed, the SCI key assigner code will hang looking for a voice and the Prophet will have to be powered off. Normally the only reason to disable a voice would be if it's not working and you want it to be skipped when assigning keys.

Latch mode:

To Tape and From tape are ignored in V10.5 unless Record is also pressed.   In V10.6, these switches still activate the tape load and save functions if record is pressed.   If record is not pressed, they are used to control other functions.   Pressing To Tape will cause its LED to light, enabling latch mode.   In this mode, any pressed keys will sound even after they are released.   Pressing more than five keys will cause the earliest notes to be swapped out as their voices are re-assigned to newer keys.   Pressing To Tape again will exit latch mode and silence all notes.

Transpose enable:

The V10.5 code includes a transpose feature which could be enabled with a command from the external sequencer. Any note played had an offset added to it, but if the sequencer was not used, this offset

was always 0.   To set the offset, one sent a command from the sequencer, and then pressed a key on the Prophet 5.   The position of the pressed key relative to C2 determined the offset.   Offsets of +/- 2 octaves were possible.   To use this transpose feature with V10.6, press and hold "From Tape".   While holding this switch, press a key.   No note will play. Release the "From Tape" switch and normal play will resume, using the offset you have set.   At power up, the transposition offset is reset to 0.

Setting a non-zero offset will affect all notes, whether their source is MIDI or the local keyboard.   If you are using the SCI Sequencer, the transpose feature should work normally.

A note about using the SCI Sequencer:

NVRAM is set up as three 1K blocks.   40 programs are stored in each block, occupying 960 bytes.   The other 64 bytes are not used. When the sequencer downloads a set of 40 programs to the synth, it writes over the entire 1K block, not just the 960 bytes that are used to save the programs.   The NV settings are stored above the programs in the second block. If you use the sequencer to download programs to the first block of 40 programs (the first "file"), the NV data should be untouched. But if you select the second block of 40 programs and use the sequencer to update them, the NV settings will be erased and the default settings will be restored at the next power-up.   Downloading programs via MIDI or cassette should not touch the NV parameters.

A word about compatibility with existing programs:

Two bits were unused in each program's 24 bytes.   These bits should always be 0's in existing programs.   One of these bits is still unused.   The other bit stores Uni1 mode status.   (1=on). Since this bit should be 0 in any existing programs, they will not select Uni1 mode.   Unison mode programs will select the normal Unison mode.

If a Unison mode program has a non-zero Oscillator B Fine setting, and Unison detune is enabled, that program may sound a little different now, since Unison detune is different from Oscillator B Fine tuning.

HW tests:

Some test code has been added which may be useful to someone who is servicing the synthesizer. The following tests have been implemented:

1) Scratchpad RAM test
2) NVRAM 2K
3) NVRAM 1K
4) LED test
5) DAC tests
   The operation of these tests is intended to mimic the operation of the factory tests which were available at one time for the P5.

To execute this code, the "OSC SCALE" (TP301) test point needs to be tied to Vcc, either directly, or through a 10K resistor , and the release foot pedal signal needs to be at logic 0 (foot pedal switch closed), when power is switched on.   You should see a "-" in the bank display digit.   This is the main monitor section of the test code. From here you can enter one of three subgroups by pressing its number:

1) Memory tests.   Displays "r" in program display digit.
2) LED test
3) DAC tests. Displays "d" in program display digit

Press 8 to exit a subgroup and return to the main monitor loop.

Memory tests

There are three memory tests.

Press 1 for scratchpad test, "S" on display

Press 2 for NVRAM 2K test, "b" for battery-backed RAM on display

Press 3 for NVRAM 1K test, "b." on display

If a memory test fails, the failing bit(s) is displayed on the program LEDs. LED 1 is bit D0, LED 8 is bit D7.

NVRAM tests copy contents to scratchpad first, then test NVRAM, then copy back. If scratchpad is OK, then the contents of NVRAM should be preserved.

LED test

The LED test walks through all of the LED's in rapid succession, one at a time.   The LED test returns to the main monitor loop upon completion.

DAC tests

Press 1 to write 0000 to the DAC

Press 2 to write all 1's to the DAC

Press 3 repeatedly to test individual DAC bits, one at a time. When bit 0 is set, the code displays a 1.

When bit 1 is set, the code displays a 2, etc.   When bit 9 is set, the code displays an "A", bit 10 shows "b", bit 11 shows "c", bit 12 shows "d", and finally for bit 13 the code displays an "E".   On the next press of the "3" switch, the DAC is reset to all 0's and the code returns to the DAC test subgroup. Note that the DAC actually has 16 bits, but the low two bits are always tied to ground.   When we say "bit 0" we mean the lowest bit of the 14 that the CPU can actually write to.

Here is a photo showing the code EPROMs in a Rev 3.2 Prophet 5:
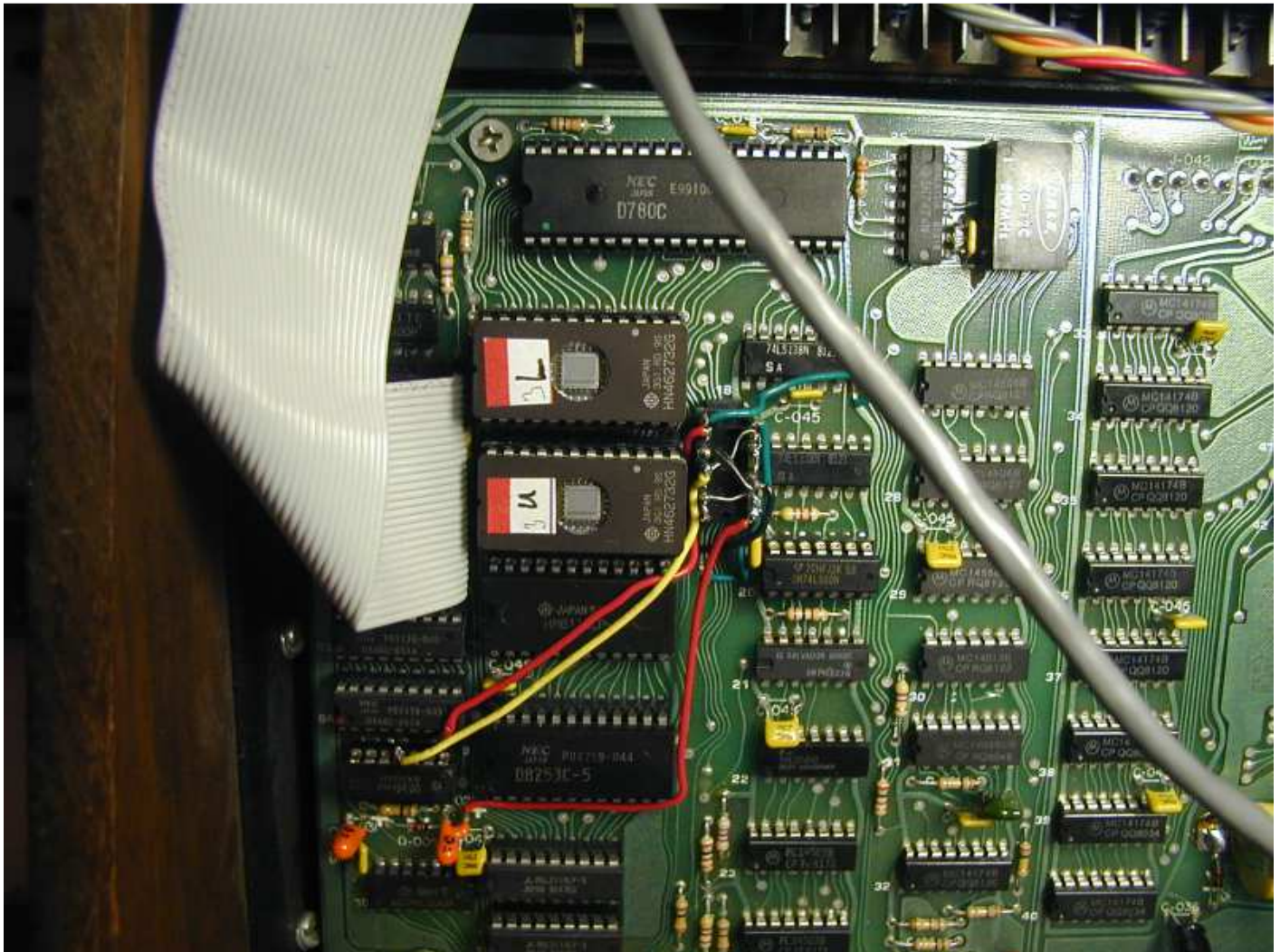
These EPROMs should normally have the windows covered to protect the contents, but I was reprogramming them often, so I left the covers off. The upper EPROM is U312 and contains the low half of the operating software. The lower EPROM is U313. The chip to the right of the EPROMs with wires running to it is part of the MIDI mod, which I moved from its original location to allow placing it in a socket. Your board will not have a chip there. The notches in the EPROMS MUST face to the left, as shown in the photo. After installing any new EPROMs, please check to see that all pins are inserted properly straight into the socket and none are bent underneath the chip.