GENERAL INFORMATION

The Patch 2000 is a digital encoding and processing system designed to produce a controled voltage (vco out) proportional to fret and string combination, and a syncronizing pulse (gate, trig, and s-trig) to control the synthesizer. The vco output is adjustable to +1 volt/octave (jumper to a') or -.3 volts/octave. Low "F", on the instrument, produces 0-vdc. There are three syncronizing outputs, which may be used separately or in combinations:

1. s-trig--0 logic level when note is sustained, 1 millisecond interupt when when note is changed. High impedence when no note is played. TTL, MOS, and CMOS compatable.
2. gate--with jumper in j-1, +15volts out while any note is sustained. With jumper in j-2, +15 volts out while note is sustained, 1 millisecond interupt when note is changed.
3. trig--1 millisecond +15 volt pulse with each new note and when any note is changed.

Controls--

1. instrument--standby operate-switch located on pick guard.
2. upper casting-- a) pitch pedal: toe down, heel up adds +1 volt to vco output (jumper to a'); heel down, toe up adds 0 volts to vco output.
   b) fifth harmony switch: on adds +7/12 volts to vco output (jumper to a'); switch off adds 0 volts to vco output.
   c) glide: varies rate of change in vco output. Toe down, heel up is slowest rate of change.

The Patch 2000 system contains six major subassemblies which plug in and are interchangeable for immediate emergency repair.

1. instrument--contains electrical connections to strings and frets.
2. instrument-circuit board--contains encoding circuitry; guitar and bass are interchangeable.
3. the top-casting--contains pitch, glide, and fifth harmony controls.
4. the master circuit board--contains digital decoding, analog scaling, and gating circuitry.
5. the power supply board--contains circuitry to produce + and - 15 volt analog supply and source for the 5 volt logic supply; the 5 volt regulator is located on the chassis. the power supply may be connected for 115 or 230 volt operation.
6. chassis--contains power transformer, 5 volt regulator, inputs, outputs, and scale adjustment.

Small Components--

The major components on the digital and analog boards are plug-in type components. Always disconnect power before changing any of these. Special attention should be given to orientation of parts when replacing, as some may be damaged if installed in reverse. Special care should be used when taking readings with instrument probes not to short adjacent pins of the I.C.

Theory of Operation--

There are two basic modes of operation, scan mode and update mode. In the scan mode frets are scanned with a ground pulse, starting with the fret nearest the bridge of the instrument. Strings are monitored one at a time, starting with the lowest string. In update mode, any change in string and fret contact updates the outputs.

Here is a complete sequence; U1 produces a clock pulse which is gated by U2 to master and remote counters. Assume the low E-string touchs the 12th fret. When the scan pulse is applied to the 12th fret, output appears at selector out. U2 now turns off clock pulses to U1, U2, and U3, U4. This frozen count in the remote counters is the same as the frozen count in the master counters, as they operate from common clock and reset lines. The number in the master counter is applied to a read-only memory, (U5, U6, and U7). The read-only memory output is applied to the input of a hex-latch (U8). Clock pulses are now routed by U2 to the update sequencer (U13,U14,U15). This produces a sequence of update commands. They are 1)set trig flip-flop to produce trigpulse if gate flip-flop is off or the number in the input of U8 differs from the number in the output of U8; this is detected by U18; 2)gate flipflop is turned on and information at the input of U8 transferred to its output; 3)master and remote counters are reset to 00000000; 4)trig flip-flop is turned off. This short duration pulse is stretched to 1 millisecond by U19; 5)route clock pulses to scan.

The 8-bit binary number stored in the output of U8 is applied to the D-A convertor U9. This produces an analog voltage proportional to the pitch that would be played by that string and fret combination. U11 forms a scaling amplifier to adjust the scale of the D-A convertor output and the pitch pedal output. U12 adjusts overall scale. Glide is achieved using the time constant produced by R-203 and C-3. U17 serves as voltage follower and output buffer. U20 turns gate off when there is no string-fret contact. Gate output may be continuous or legato, depending on the position of J-1. For use with synthesizers having a normal negative voltage at their gate or trig inputs, remove jumpers on master board and install diodes D-6 and D-7.

Check-out and Alignment--

Equipment required; four-digit digital volt meter, D.C. to 10M.H.Z. triggered sweep oscilloscope, a 3-4inch jumper wire fitted with miniature alligator clips; you will require approximately four square feet of service area to disassemble the unit, and a standard audio or instrument cable.

Disassembly instructions:
DISCONNECT POWER FIRST

1) turn unit upside down and remove the four rubber feet and three aditional screws holding the top casting to the chassis.
2) turn unit upright.
3) lift top casting from chassis, rotate clockwise 180 , and set to left side of chassis.

Alignment instructions:

1) check power supply board for proper 115 or 230 volt connection.
2) connect power to disassembled unit; turn on and allow to warm up for ten minutes. DO NOT CONNECT GUITAR OR BASS DURING ALIGNMENT.
3) temporarily disconnect P-~~4~~ 6 plug on master board. This plug connects the outputs of the master board to the rear jacks and scale adjust. Locate the scale adjust on rear panel of chassis (orange and white wires), and set for 25k ohms.
4) reconnect P-~~4~~ 6 to the master circuit board.
5) rotate pitch and glide controls heel down, toe up.
6) connect digital volt meter to vco output (violet).
7) connect a small jumperfrom the strobe input (green wire on P-5) to Y test point located at the bottom of ~~U16.~~ U7. Output should be approx. 0 volts. Note any residual voltage (typ. ± or -.017).
8) Move jumper to test point X located near the top of ~~U16.~~ U7. Be sure to maintain a solid connection to strobe input.
9) check jumper to be sure connection is to a'.
10) adjust R-13* for +2.000volts plus residual (in previous example, adjustment would be 2.017 volts.) *near U12
11) connect oscilloscope to trig output (green wire on rear chassis). With strobe still connected to test point X, short test point X to test point Y. Each time this occurs, a trig pulse will be produced. The vco voltage will go to 0 volts.
12) connect oscilloscope to gate output; connect jumper to J-2. gate output should be 15 volts.
13) remove strobe from T.P.-X. Gate should go to 0.
14) reconnect jumper to T.P.-X. Short T.P.-X to T.P.-Y as in step 11. Gate should go to 0 volts for 1 millisecond each time this occurs.
15) place gate jumper to J-1. Short T.P.-X to T.P.-Y as in step 11. No change should occur.
16) Disconnect strobe from T.P.-X; gate should go to 0.
17) reconnect strobe to T.P.-X. Parallel gate and s-trig outputs with an audio cable.
18) short T.P.-X to T.P.-Y as in step 11. A 1-millisecond pulse should appear on the oscilloscope.
19) connect strobe to T.P.-Y. Note residual and vco output.
20) rotate pitch pedal toe down, heelup; set R-14 (near ~~U12~~ U17) for 1.000 volts plus residual (example: 1.017 volts).
21) connect strobe to T.P.-X; rotate pitch pedal heel down, toe up; note reading on volt meter. Rotate glide pedal toe down, heel up; reading should change by less than .01v.
22) short T.P.-X to T.P.-Y as in step 11. Connect oscilloscope to vco output. vco output should glide smoothly up and down when X is shorted to Y as in step 11.

Unit is now callibrated.

(Glide and pitch pedals heel down, toe up position.)

T.P.-Y: U9 pin-8 --- ±.02VDC
U11 pin-1 --- ±.02VDC
U11 pin-7 --- ±.02VDC
U12 pin-1 --- ±.02VDC
U12 pin-7 --- ±.02VDC

T.P.-X: U9 pin-8 --- +4.33VDC
U11 pin-1 --- -2.46VDC
U11 pin-7 --- ±.02VDC
U12 pin-1 --- +2.01VDC
U12 pin-7 --- -.650VDC

Rotate pitch toe down; jumper to T.P.-Y:

U11 pin-1 --- -.02VDC
U11 pin-7 --- -1.208VDC
U12 pin-1 --- +1.01VDC — +1.010 DC
U12 pin-7 --- -.326VDC

FIELD ALIGNMENT WITH SYNTHESIZER--

1. Turn on unit and synthesizer; allow to warm up for 10 minutes.
2. Disconnect power; disassemble unit. Pitch and glide are toe up, heel down.
3. Connect unit to synthesizer; connect jumper from strobe to T.P.-X (see step #11 in previous alignment instructions). Connect power; short X to Y. Synthesizer should change in pitch exactly 2 octaves--adjust R-13 (near U12). If the range of R-13 is insufficient, adjust scale for over 2 octaves; adjust to exactly 2 octaves with R-13.
4. Place jumper on T.P.-Y; rotate pitch pedal toe down, heel up. Adjust R-14 (near U17) for change in synthesizer pitch of exactly 1 octave. if range of R-14 is insufficient, adjust scale for over 1 octave; then adjust R-14 for exactly 1 octave. **If it is necessary to change the scale adjustment in this step, step #3 must be repeated.

Unit is now aligned.

TROUBLE SHOOTING GUIDE FOR MASTER BOARD--

MALFUNCTION	POSSIBLE CAUSE
no clock, no action	U1, U2
gate will not turn off after note is played	U3, U20, U16, U10
pattern of notes repeat when string is fretted from bottom fret up towards bridge	U1, U2
a)1-2-1-2, or 1-2-3-4-1-2-3-4	U3
b)1-2-3-4-5-6-7-8	U4
improper interval tracking--string to string	U5, U6, U7, U8
very distorted soung from synthesizer resulting from erratic VCO output	U5, U6, U7, U8
multiple or continuous trigger pulses	U16, U10, U19, U18, U9, U13
no trig pulses	
no gate	U15, U16, U10, U20
no s-trig	U15, U16, U10, U20
noise on VCO	U17, U12, U11, U9
VCO drift	U17, U12, U11, U9
will not update to new note	U14, U15, U18, U13
inverted VCO	jumper to A, place on a', U11, U12
no action on pitch pedal	D-4, R-204
no action on glide pedal	C-3, U17
pitch changes when glide is depressed	U17 ~~[illegible]~~ C-3