



Master Assembly

HELIOS W2S/SV/T

AM 072

1 PREFACE

The following extracts are taken from the Master Assembly Manual for the Helios, to cover the layout of the organ modules, testing, and cable-form wiring.

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2.1 FIGURES

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2.2 TABLES

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Figure 1 Layout of the building blocks in the organ top

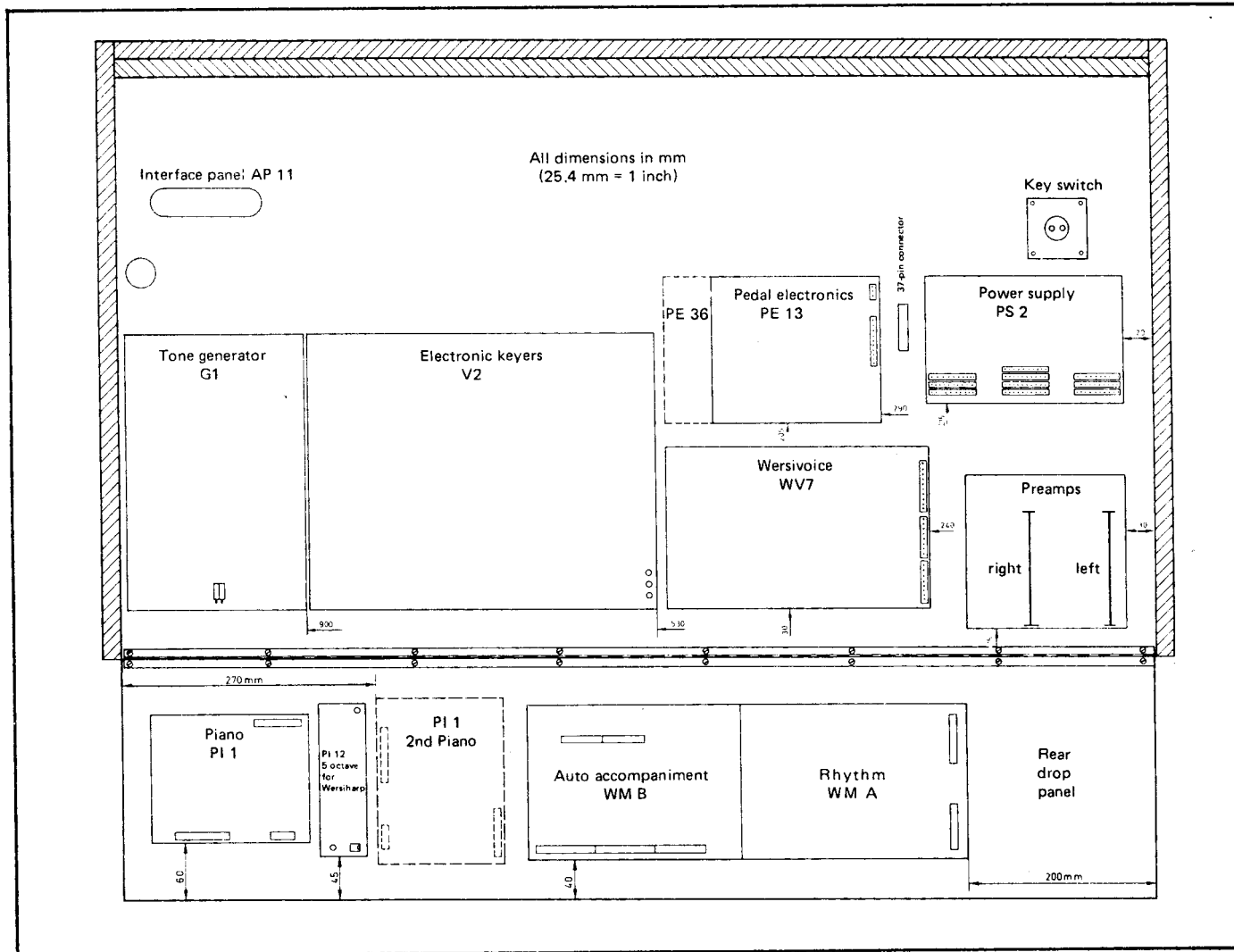
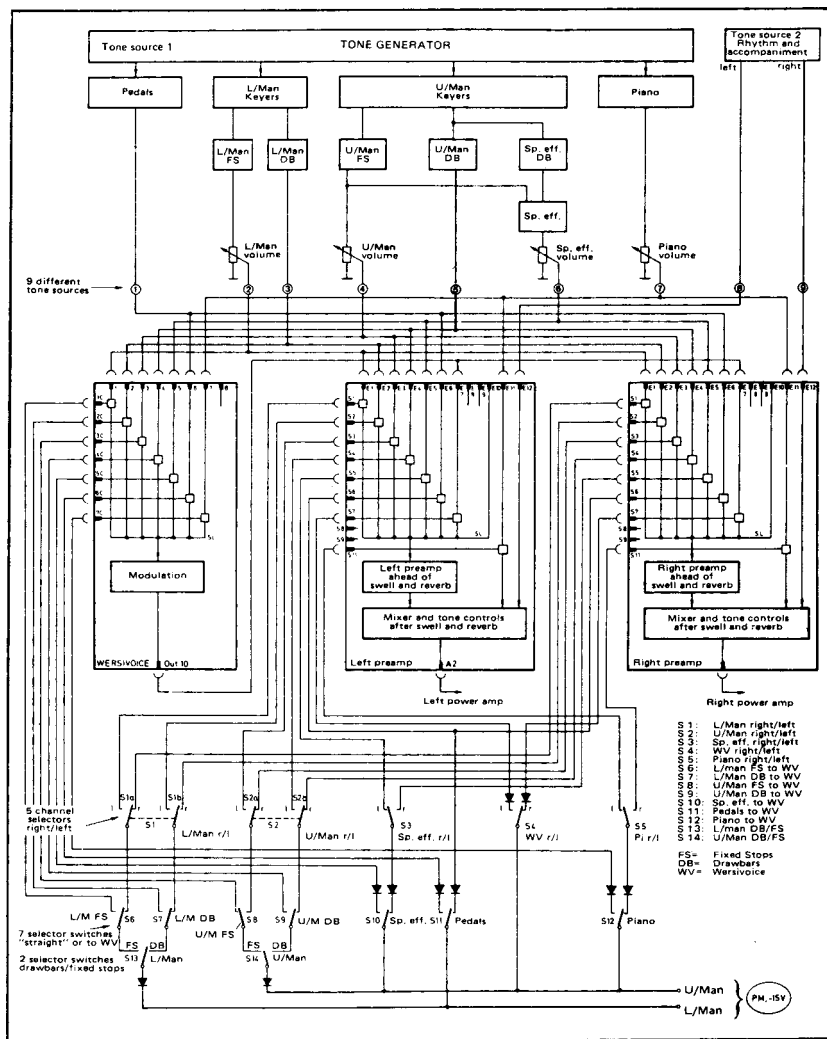


Figure 2 Block diagram of the audio wiring and associated DC controls



3 Initial Operation and Adjustments

We suppose that power supply, tone generator and electronic keys have passed the previous tests and are in good working order. We further assume that the organ is equipped with operating power amplifiers and speakers (internal speaker for W 2 S/SV, external speakers for W 2 T).

Only some of the connectors of the wiring harness G O 2 are to be connected at this point in time. If in doubt, verify which ones are to be plugged in by rereading chapter G.

3.1 Preparations

() Cut off a 100 cm (40") long piece of hookup wire (any colour). Solder an alligator clip to one end and connect the other end to -15 V of the power supply (together with the large number of blue wires).

This lead will serve as test wire to activate the various analogue audio switches.

3.2 Conventions and Initial Conditions

A tongue tab is said to be "OFF" when it is in its upper position.

A rocker tab is considered "OFF" when it is sloping down towards the rear (rear portion pushed down).

A drawbar is "OFF" when it is pushed home.

() Turn off all tongue tabs and rocker tabs.

() Push home all drawbars (including master controls).

- () Set the "Wah Wah" and "Slalom" controls to their right-hand stops.
- () Set the transposer to "C" (normal pitch).
- () Set the master pitch control (on A P 1) to the centre of rotation.
- () Depress the swell pedal completely.
- () Push the programming switch "Cancel" (if applicable).

3.3 First-Time Power On

Important: There will be AC line voltage present from now on at various locations in the organ. Keep your hands away from the A C line connector, power transformer, AC toggle switch and pilot light.

- () Turn on power to the organ for a few seconds only. Quickly scan the instrument with your eyes and nose on the lookout for smoke. The power amplifier may hum and hiss slightly and even a few faint sounds may be heard. But there should be no July 4 spectacle taking place.
- () If everything seems to behave in an orderly manner check the power supply voltages (+ and -15 V D C).
- () In case of trouble at this stage remove the supply lines at the subunits throughout the organ one by one (but positive and negative lines simultaneously) to isolate the culprit. Keep notes of what you are doing such that you can restore the instrument after locating the problem.
- () Confirming test for operating power supply, tone generator and power amplifier: Hold a finger of one hand to the terminal "E" of the power amplifier. The amplifier will hum now. Run a finger of the other hand along the foil side of the circuit boards G 2 of the tone generator. Tones should be heard besides all other noises.
- () Jam a key of each manual in the depressed position. While holding on to the amplifier terminal, touch the terminals 'IQ" or "SIN" of the keyer block. Again, tones at various pitches should be heard.

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3.4 Testing of the L/Man Drawbars

- () Set all trimpots on the preamplifiers to their centres of rotation.
- () Pull all 7 drawbars of the lower manual out half way.
- () Jam a key in the centre of the lower manual in the depressed position. There should be no audible sound yet.
- () Clip the test lead to plug 4, terminal S 2 of the right preamp. The drawbar signal should appear from the right speaker.
- () If no tone is heard touch the terminal E 2 (plug 3) of the right preamp with one hand (use a short piece of bare wire to reach down into the rear opening of the connector) and touch the input pins of the lower manual drawbars with your other hand. You should hear 7 different pitches when touching the drawbar pins sequentially. If no tones appear the problem is likely to be found on the preamplifier. Are the supply voltages present? Do you measure - 15 V D C at the control terminal S 2? Is the ribbon cable installed underneath the preamplifiers?
- () Clip the test lead to the terminal S 2 of the left preamp. The sound should now appear from the left speaker.
- () If a problem appears to be confined to the preamplifiers consult the manual AM 540 and find out which IC's are responsible for the input gating of E 2/S 2. Swap IC's of like types.
- () Push all drawbars except the left most drawbar home. The sound will disappear. Pull out single drawbars of the lower manual one by one and check for proper sequence of the pitches. Release the key on the lower manual.

3.5 Testing of the Lower Manual Envelope Control

The operation of the 4 envelope control switches for the lower manual (lower right cheek block) can be tested by using the drawbars.

- () Turn on the switch "Soft Attack" (lower right cheek block). When depressing a key on the lower manual the tone buildup should be slower than before.

() Turn on the switches "Short Sustain"; "Medium Sustain" and "Long Sustain" successively. The tone decay after the release of a key should become progressively longer.

[] Should any of these functions not operate properly fasten a second test lead to -15 V of the power supply and clip it directly to the pins "Att. soft", "Sustain short"; "Sustain medium" or "Sustain long" on H K 13 of the lower manual.

If the envelope modes now are working okay the problem will be found in the wiring (see wire list). If not the trouble is located on the envelope control boards H K 13 or H K 12 of the lower manual (though they were tested previously).

3.6 Testing of the Drawbars and Envelope Control of the Upper Manual

Repeat the tests of the preceding chapters IV and V. However, apply the test lead to one or the other preamp terminal S4, jam a key on the upper manual and test a total of 11 pitches.

After the completion of the tests for the upper manual, remove the test lead and push all drawbars home.

3.7 Testing of the Lower Manual Fixed Stops

() Jam a key of the lower manual in the depressed position.

() Turn on a few fixed stops of the lower manual.

() Pull the volume control "L/Man" out mid-way.

() Push the connector from the harness G O 2 onto the pins of "Plug 2" (GP 1 of lower manual).

() Clip the test lead to pin S 1 of the right preamp. The selected fixed stops will now be audible from the right speaker.

() Check the presence of all fixed stops and compare the sound character with the list below:

3.7.1 Fixed Stop Voices of the Lower Manual

1. Gedackt 8': Mellow, somewhat hollow sound of a "stopped" pipe.

2. Viola 8': Bright, rich in harmonics.

3. Principal 8': Broader spectrum than Viola 8; but still rich in harmonics.

4. Horn 8': "Hollow" sound.

5. Violin 4': Same as Viola 8' but pitched one octave higher.

6. Principal 4': Broader spectrum than Violin 4; but still rich in harmonics.

7. Nasat 2-2/3': Sounds one fifth higher than the 4' stops (G appears on a C key). This is a fill-in voice (not a solo stop) and sounds softer than the 4' stops.

8. Principal 2': Same as Principal 4' but pitched one octave higher, repeats at the highest C.

9. Third 1-3/5': Sounds one third higher than the 2' stop (E appears on a C key). Colouring fill-in voice.

10. Fifth 1-1/3': Sounds one fifth higher than the 2' stop (G appears on a C key). Colouring fill-in voice.

11. Piccolo 1': Thin, high pitched stop. Repeats at the last key.

12. Mixture II: Combination of 1' and 1-1/3', adds brilliance to a combination of lower pitched stops. Round tone, few harmonics.

() Clip the test lead to pin S 1 of the left Area m p and test a few stops. The sound should now appear from the left speaker.

3.8 Testing of the Fixed Stops of the Upper Manual

() Jam a key of the upper manual in the depressed position.

() Turn on a few fixed stops of the upper manual.

() Pull the volume control " U/M an " out mid-way.

() Push the connector from the harness G O 2 onto the pins of "Plug 2"(GP 1 of upper manual).

() Clip the test lead to pin S 3 of either preamp. The selected fixed stops will now be audible.

() Check the presence of all fixed stops and compare the sound character with the list below:

3.8.1 Fixed Stop Voices of the Upper Manual

1. Cello 16': Rich full sound with plenty of harmonics.
2. Flugelhorn 16': Hollow sound, somewhat nasal character.
3. Accordion: Very brilliant stop, containing plenty of harmonics.
4. Trombone 16': Powerful and broad sound, becoming "buzzy" at the lowest octave.
5. Saxophone 16': Rich in harmonics, becoming increasingly "hollow" towards the bass end of the manual.
6. Horn 8': Hollow sound, fundamental tone slightly suppressed.
7. Viola 8': Bright sound, rich in harmonics,
8. Clarinet 8': Typical woodwind tone.
9. Oboe 8': Thin woodwind, brighter than clarinet 8:
10. Flute 8':
11. Trumpet 8': Loud and bright brassy tone.
12. Flute 4': Same as Flute 8', but sounds higher by an octave.

13. Violin 4': Same as Viola 8', but an octave higher, almost no fundamental tone.

14. Nasat 2-2/3': Sounds one fifth higher than the 4'stops(G appears on a C key). Subdued voice as fill-in.

15. Principal 2': Bright and powerful, rich in harmonics, repeats at the highest C.

16. Piccolo 1': Thin, high-pitched stop, repeats after the C key of the 4th octave.

17. Cymbal V: Very bright mixture, even piercing, retains its character over several octaves of the manual.

18. Mixture III: Less brilliant than the Cymbal V, turns fuller towards the lower octaves of the manual.

() Again, test the changeover of the sound to the other channel by clipping the test lead to pin S 3 of the other Preamp.

3.9 Testing of the Frequency Vibrato

The fixed stop voices of the upper manual can be used to test the various modes of the frequency vibrato.

We suppose that the tone generator was tuned after its assembly.

() Push the connector from the harness G02 onto the pins of circuit board U S1 " Reverb/Vibrato, em"

() Verify that the pitch of the entire organ varies by an exact octave when the "Slalom" control is moved from stop to stop. Remark: If you installed a "Slalom" control which is different from the one you tested the tone generator with the generator will have to be retuned due to the resistance tolerance of different controls.

Standard pitch (higher pitch) should exist with the "Slalom" control at its right-hand stop.

() Turn on the push button switch "Delayed Vibrato".

() Depress one or more keys in the upper manual. After a short delay a weak vibrato should appear. The delay is initiated everytime a key is depressed after a pause in playing. The delay time can be adjusted by means of trim pot P 3 on the tone generator board G 1. Our recommendation: centre of rotation.

() Turn off "Delayed Vibrato" and turn on "Contin. Vibrato". The vibrato exists immediately when a key is depressed.

() In addition, turn on "Vibrato II": The intensity (or depth) of the vibrato increases.

() Turn on "Vibrato III" additionally. This causes the heaviest vibrato. By the way, the two vibrato intensity switches II and III are effective only in conjunction with a turned on "Delayed Vibrato" or "Contin. Vibrato".

() Turn on yet "Slow Vibrato". The previously fast vibrato should slow down about 40%.

3.9.1 General Procedure in Trouble-Shooting of Switch Functions

All modes of operation of the various building blocks throughout the organ which are controlled by a mechanical switch are activated as follows: The switch sends a

negative (-1.5 V D C) control voltage to the corresponding location. Since it is irrelevant from where the control voltage originates we can also activate a particular function with the help of our test wire.

Example: Suppose that the function "Slow Vibrato" does not work while all other vibrato modes are operating properly. First, we trace the control voltage.

We find that the switch "Slow Vibrato" is shown in Fig. 73. The control wire is No. 176. The wire list states that the other end of wire No. 176 is connected to the tone generator G 1, plug A, pin 3.

Using our test lead (extended with a piece of bare wire) we touch this pin on the generator. There are two possible results, namely:

- a) The vibrato does not slow down,
- b) The vibrato slows down.

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In case a) the problem is located on the tone generator board (though it was tested; did you miss that test?).

In case b) we conclude that the control voltage does not arrive at the tone generator.

Where did it get lost? In the harness? That is easy to verify by touching the corresponding pin of the switchbank (other end of wire No. 176). If the vibrato does not slow down we have to assume that the wire you see emerging from the switch bank is not the one arriving at pin A 3 on the generator.

More likely, the vibrato will slow down, giving rise to two new questions:

- a) Is the switch "Slow Vibrato" defective?
- b) Is the control voltage for the entire switch bank missing?

Question b) can be brushed aside immediately since the other switches of the same group do control their functions.

The last locations of the trouble are, therefore, the switch itself, the foil pattern on the board U S 1, or the diode in series with the switch.

Clip the positive test lead of your voltmeter (15 V D C or greater) to ground and test the following points in the indicated sequence:

- 1) Switch bank pin "p m " (master control voltage for entire switch bank).
- 2) One of the two pins at the rear of the switch (no voltage = defective switch).
- 3) Pin a where pink wire is connected (no voltage = defective diode, wrong polarity of diode or interrupted foil pattern). Also refer to Fig. 37 for layout.

It took us quite a few words to describe this procedure. We hope that you understand the fundamental idea behind all trouble-shooting.

- a) Identify the function that is not working.
- b) Locate the "sender" of the control signal (usually a switch).
- c) Trace the signal, using the wiring list, hookup drawings and foil pattern reproductions of this and/or other manuals.
- d) Trace the path backwards by means of the test wire or follow it forwards by using a voltmeter.

Important: Keep your inner cool and - if somebody else is watching - maintain an air of "situation under complete control".

3.10 Testing of the Slalom Modes (Autoglide)

() Turn off all switches of the group " Reverb/ Vibrato/ Slalom". Set the "Slalom" slide control to its right-hand stop. Set the transposer to " C " (normal pitch).

() Depress a key on the upper manual and simultaneously depress the button "Autoglide". The pitch should shift downwards by an exact octave overtime the key is depressed anew. Prerequisites: properly tuned generator and correctly positioned transposer (the knob may be at "C" but what about the switch proper?).

() Depress, in addition, the switch "Autoglide Up/ Down". The pitch shift will be upwards now.

() Increase the "travel speed- of the octave glide by pulling out the slide control " Autoglide Speed':

() The "travel distance" can be limited to less than an octave by moving the "Slalom" control away from its right-hand stop. This varies the high end of the pitch glide only.

() The transposer also changes the upper limit. Set the transposer to any other position than "C" and test the autoglide. It will move between the low "C" and the tone determined by the transposer. The slide control "Slalom" is disabled when the transpose is not at the C-position.

() Turn the master pitch control (underside of organ top) from stop to stop. The overall pitch of the organ should vary by about plus and minus a half-tone.

() Activate the right-hand foot switch on the swell pedal. The pitch should drop rapidly by about a half-tone and return slowly to normal. Premature release of the " Hawaii" switch causes the pitch to return more rapidly. If you have the impression that the pitch stays slightly "flat" while the footswitch remains deflected you have a good ear (the pitch is off by about one twentieth of a half-tone).

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() We no longer require the test lead. Remove it from the power supply.

3.11 Testing of the Selector Switches " Drawbars/Fixed Stop"

() Push the connector from the harness G02 onto the pins of "Plug 1 " of circuit board G P 1 L/M an (voicing board of lower manual).

() Turn on a few fixed stops in the lower manual.

() Pull a few drawbars of the lower manual.

() Push the connector for plug 4 on the right preamplifier onto the pins. Set the volume control " L/M an" about mid-way.

() Hold a chord on the lower manual and alternate the positions of the tongue tab " Drawbars/Fixed Stops" of the lower manual. You should hear the drawbar sound with the switch in the "up" position and the fixed stops in the "down" position.

() Turn on all fixed stops of the lower manual. Pull out all drawbars of the lower manual.

() Hold down a key or chord on the lower manual. Alternate between drawbars and fixed stops and balance the volume of the fixed stops with the one from the drawbars by means of trim pot P1 on GP 1(L/Man).

() Repeat the entire procedure from the beginning of this paragraph XI for the upper manual.

3.12 Testing of the Wersivoice

() Push the 3 connectors from the harness G O 2 onto the pins on the Wersivoice circuit board WV 7.

() Turn off any vibrato (switches " Reverb/Vibrato, etc.

() Select some bright fixed stops in both manuals and pull the drawbars for a matching bright sound.

() The switches "Drawbars to Wersivoice" and "Fixed Stops to Wersivoice" (in both manuals), when pushed down, assign the respective sounds to the Wersivoice. (The switch "Drawbars/Fixed Stops" pre-selects the tone sources). The Wersivoice imposes a rather complex vibrato on the sound such that it seems to emerge from rotating speakers or baffles.

The Wersivoice switches on the stop board are "off": In that case the vibrato (Whirl) is at its normal intensity and at the fast speed.

() Set the trimpot P 1 (Output) on the Wersivoice circuit board W V 7 to the centre of rotation.

() Find the position on P 2 (Input) on W V 7 where distortion occurs either using all drawbars or many fixed stops. Then, back off the volume until the distortion disappears.

() Now adjust P 1 (Output) such that the volume is the same in both positions of the switch "Drawbars to Wersivoice" (using drawbars of the upper manual).

Hold a full chord, using drawbars in the upper manual. Turn on the rocker switch "Fast/ Chorale". The vibrato should be slow now (chorale speed).

() Turn the switch "Fast/Chorale" off again. The vibrato speed should increase slowly until it reaches the fast (normal) speed. The Wersivoice simulates the inertial speed-up of mechanical rotators.

() Turn on (down) the rocker switch "Speed shift Slow/Fast". When the speed is changed now from slow to fast the speed shift takes place instantaneously (no longer simulating any mechanical inertia). The speed change from fast to slow (chorale) remains sudden, independent of the setting of the switch "Speed shift Slow/ Fast":

() Turn on the switch "Heavy" (also called "Celeste"). The intensity of the vibrato should increase.

() Turn on the switch "Soft" only (also called "Chorus"). The vibrato becomes less intense.

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() Turn on both "Heavy" and "Soft": The result is an intensified vibrato (like the one you hear when holding your ear very close to a rotating speaker). Thus "ultra-heavy" vibrato is disabled automatically (and reduced to "normal heavy") at the chorale speed.

() Turn on the switch "Whirl/Choir" only. The Wersivoice is now in its voice-multiplying mode (also called string orchestra mode). The incoming voices (coming from single instruments) are transformed into sets or choirs of voices. The two intensity switches perform similar duties as in the "Whirl" mode. The "Fast /Chorale" switch, however, is disabled. For more details, refer to the manual A M 465 "Wersivoice".

3.13 Testing of the Channel Selectors

() Push the connector for plug 4 onto the pins of the left preamplifier.

() While playing on the upper manual, activate the channel selector switch "U/Man Left/Right": The sound should switch back and forth between the amplifier channels.

() Repeat the procedure for the lower manual.

() Assign the drawbars and/or fixed stops of the upper manual to the Wersivoice and play on the upper manual. Activate the switch "Wersivoice Left/ Right". The sound should alternate between channels.

3.14 Testing of the Swell Pedal and Reverb

() Push the connector of the harness GO 1 onto the pins of "Plug 1" of both preamplifiers (board V V 1). Refer to Fig. 49 for proper orientation of the connectors.

() Set all channel selectors to "Right".

() Test the volume control operation of the swell pedal while playing.

() Take the swell pedal back all the way (up). Adjust the trim pot "Null" on the right channel V V 1 for minimum volume.

- () Set all channel selectors to "Left".
- () Repeat the "Null" adjustment for the left channel.
- () Turn on the switch " Reverb I" and push the swell pedal down. Hit a chord briefly and observe the reverb.
- () Turn off " Reverb I" and turn on " Reverb II": The reverb time should be lengthened.
- () Adjust the trim pots P 2 on each V V 1 such that the longest reverb (" Reverb I and II" turned on) suits your personal taste. Our recommendation: centre of rotation.
- () Set both treble controls P 3 on V V 1 (top) and the bass controls P 4 (centre) to the centre of rotation. Later on, you may want to re-adjust these controls to match the organ sound to the room acoustics.
- () Set the trim pots P 5 on VV 1 (bottom) for the highest desired volume from your speaker when the swell pedal is fully depressed and when you play with "full organ".

3.15 Testing of the Special Effects

The testing and adjusting of this building block is described in the manual A M 400 "Special Effects".

- () Push the three connectors from the harness G O 2 onto the pins on circuit board E F 1.
- () Test all functions of the "Special Effects"; referring to AM400.
- () Test the alternate audio path of the "Special Effects" via the Wersivoice while turning on the switch "Spec. Eff. to Wersivoice".
- () Also test the operation of the switch "Spec. Effects Left/Right".

3.16 Testing of the Pedals

- () Restore the controls of the organ as described at the beginning of paragraph II.
- () Push all connectors onto the pedal electronics board PE 13 or PE 36.
- () Pull all pedal drawbars about half-way.
- () Turn on the switch " Drawbars" of the pedal switch bank.
- () Play the pedals, note for note. The sound should be present on both channels simultaneously.
- () Test the operation of the pedal drawbars (5 brown ones only) one by one.
- () Turn on the switch "Sustain On". This will result in a short sustain after the release of a pedal.
- () Turn on the switch "Long Sustain" which should result in a (guess what) longer sustain.
- () Turn off the switch " Drawbars".
- () Turn on the switches "Trumpet"; "Tuba" and "Stringbass" one by one and test these voices. The tuba is pitched one octave below the two other voices. The black drawbar "Fixed Stops" controls the volume of these stops.
- () Turn on the switch "Pedals to Wersivoice" in connection with a fixed stop. (The most interesting setting is achieved with stringbass and the Wersivoice in the "Choir" mode.)
Turn off all switches and turn on "Bass Guitar" only.
- () Play the pedals, note for note. Adjust the percussive pluck of the bass guitar to suit your taste (trim pot P1 on PE13). Our recommendation: approx. 3/4 clockwise.

3.17 Testing of the Piano, Wersidata Registration Programming and Wersimatic Rhythm /Auto Accompaniment

These building blocks are to be installed, wired and tested according to their respective assembly manuals.

4 Final Steps

When you reach this chapter you have completed a considerable amount of work. We congratulate you for this achievement.

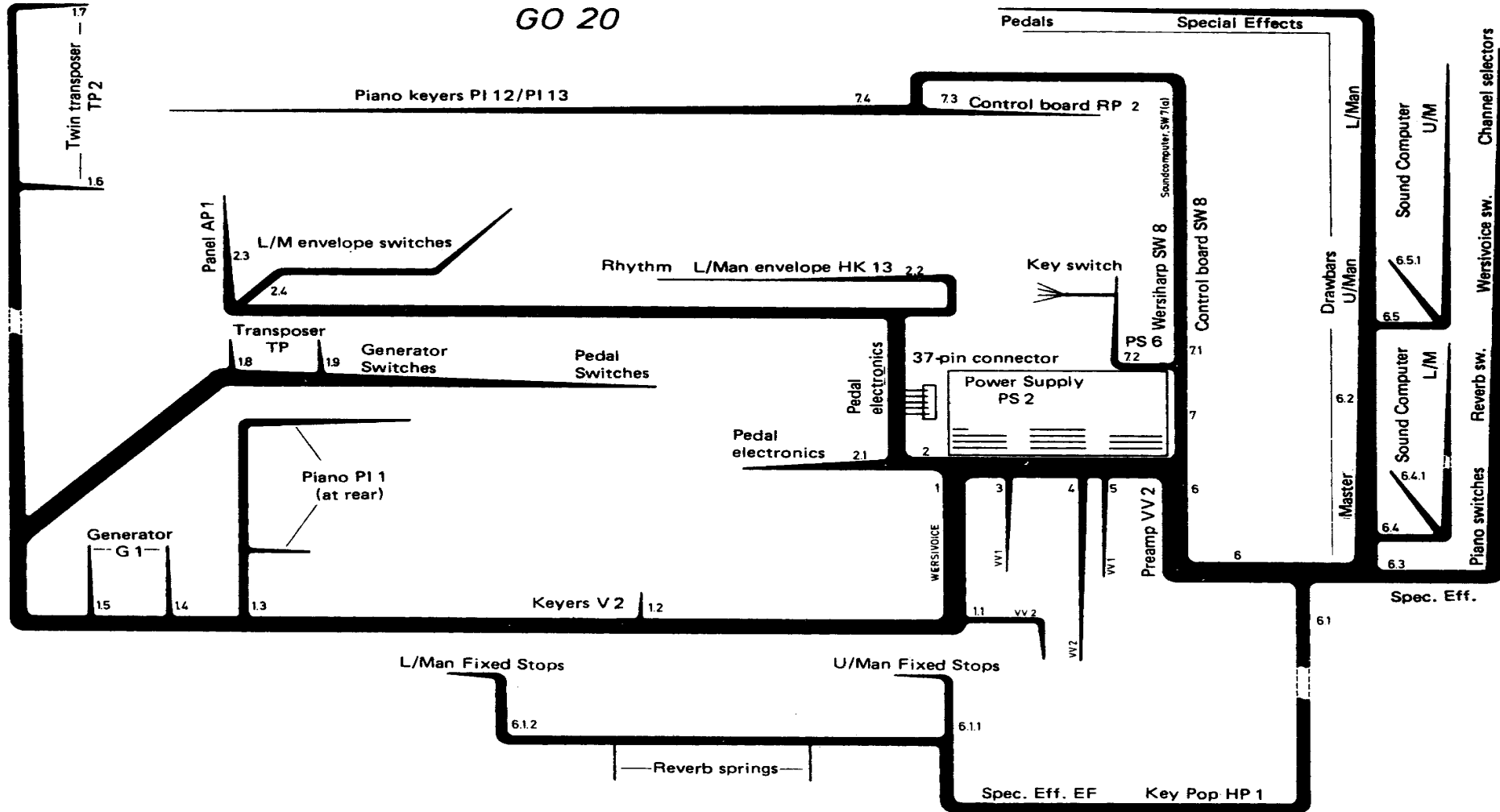
But, please, tone your haste and spend some time for the final cleanup. Inspect the instrument for loose particles and tools. Use a vacuum cleaner to suck up the

remaining debris. (Some small strands of wire have a tendency to lodge somewhere between terminals and components where they can cause the famous "demonstration effect" during your inaugural concert.) Fasten the swell pedal cover (W 2 S/SV) and close up the rear panel (s).

We wish you many years of enjoyment with your HELIOS. Since you built this instrument yourself you are thoroughly familiar with its musical capabilities. Maybe you want to start your playing experiments with duplicating some of the sounds Klaus Wunderlich displays live on his LIP "Wersitime 2". His registration information on the liner notes pertain to the model W 2 S, the principles hold true for the models W 2 T and W 2 SV too.

An electronic orchestra of the versatility of the HELIOS will likely lead to new discoveries in the areas of sound effects and playing tricks among the many users. We would appreciate knowing about such innovative ideas and will publish them in our newsletter for the benefit of all other musicians.

Figure 3 Schematic layout of the wiring harness GO 2



The wiring list on the following pages contains the wire numbers, colors and types of wires used in the harness GO 2. Beginning and end of each wire are also identified as to subunit name and terminal designation as far as the wiring of the organ is concerned, we do not make use of this list. It is provided as an aid in trouble-shooting and for future reference.

Table 1 Wire List of Harness GO 2

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
1	W red	Power supply PS 1,+15 V	Preamp VV 2, left, plug 5,+15.	Pos.supply voltage
2	W red	Power supply PS 1, +15 V	PE 13 (36),plug 7, pin +15	Fos. supply voltage
3	W red	Power supply PS 1,+15 V	Wersivoice WV 7, pin +15	Pos.supply voltage
4	W red	Power supply PS 1,+15 V	Preamp VV2,right,plug 5, pin +15	Pos.supply voltage
5	W red	Power supply PS 1,+15 V	Key Pop, H P 1, pin +V	Pos.supply voltage
6	W red	Power supply PS 1,+15 V	Matrix board V 2, term. +15	Pos.supply voltage
7	W red	Power supply PS 1, +15 V	Piano PI 1, plug 3, pin +15	Pos.supply voltage
8	W red	Power supply PS 1,+15 V	Generator G1, plug A, pin 4	Pos.supply voltage
9a	W red	Power supply PS 1, +15 V	Piano keyers PI 13, term. +	Pos.supply voltage
9b	W red	Piano keyers PI 13, term. +	Piano keyers PI 12 (2nd oct.),term.+	Ext.of wire No. 9
9c	W red	Piano keyers PI 12(2nd oct.l,termA	Piano keyers PI 12 (3rd oct.),term.+	Ext.of wire No. 9
9d	W red	Piano keyersPI12l3rd oct.),term.+	Piano keyers PI 12 (4th oct.),term.+	Ext.of wire No. 9
10	W red	Power supply PS 1,+15 V	Special effects E F 2,Plug 2,pin 19	Pos.supply voltage
11	W red	Power supply PS 1,+15 V	FS, UM, G P 1, plug 2, pin +15	Pos.supply voltage
12	W red	Power supply PS 1,+15 V	FS, LM, G P 1, plug 2, pin +15	Pos.supply voltage
13	Not used			
14	W blue	Power supply PS 1, -15 V	Twin Trans. TP 2, Plug t, pin -15	Neg. supply voltage
15	W blue	Power supply PS 1, -15 V	Preamp VV 2, left, plug 5, pin -15	Neg. supply voltage
16	W blue	Power supply PS 1, -15 V	PE 13 or PE 36, plug 7, pin -15	Neg. supply voltage
17a	W blue	Power supply PS 1, -15 V	Envelope LM, H K 13, term. -15	Neg. supply voltage

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
17b	W blue	Envelope L/Man H K 13, Pt. -15	Bus bar L/Man	Ext.of wire No. 17a
18	W blue	Power supply PS 1, -15 V	Master pitch control, term. A	0 n int. panel AP 11
19	W blue	Power supply PS 1, -15 V	Wersivoice WV 1, pin 17	Neg. supply voltage
20	W blue	Power supply PS 1, -15 V	Preamp VV 2, right, plug 5, pin -15	Neg. supply voltage
21	W blue	Power supply PS 1, -15 V	U M S.C. S C 6 B,plug 2, pin 24	Neg. supply voltage
22	W blue	Power supply PS 1, -15 V	Matrix board V 2, term. -15	Neg. supply voltage
23	W blue	Power supply PS 1, -15 V	Piano, PI 1, plug 3, pin -15	Neg. supply voltage
24	W blue	Power supply PS 1, -15 V	Generator G 1, plug A, pin 8	Neg. supply voltage
25	W blue	Power supply PS 1, -15 V	U M E nv. Sw. SW 8, plug 1, pin 1	Neg. supply voltage
26	W blue	Power supply PS 1, -15 V	Contr.board, R P 2, pad 2	Neg. supply voltage
27a	W blue	Power supply PS 1, -15 V	Envelope U M H K 13, term. -15	Neg. supply voltage
27b	W blue	Envelope U M H K 13, Pt. -15	Bus bar U/Man	Ext.ofwire No. 27a
28	W blue	Power supply PS 1, -15 V	Piano keys PI 13, term. V	Neg. supply voltage
29	W blue	Power supply PS 1, -15 V	Special effects E F 2, plug 3, pin 24	Neg. supply voltage
30	W blue	Power supply PS 1, -15 V	FS U M G P 1, plug 2, pin -15	Neg. supply voltage
31	W blue	Power supply PS 1, -15 V	FS LM G P 1, plug 2, pin -15	Neg. supply voltage
32	W blue	Power supply PS 1, -15 V	Special effects rate cont.term. S	Neg. supply voltage
33	W blue	Power supply PS 1, -15 ,V	LM S.C. S C 3 B, plug 2, pin 24	Neg. supply voltage
34	W blue	Power supply PS 1, -15 V	Key pop H K 1, pin -V	Neg. supply voltage
35	W blue	Power supply PS 1, -15 V	SC Cont.SW 7, pin 13	Neg. supply voltage
36	W blue	Power supply PS 1, -15 V	Key switch U S 1, pad p m	Neg. supply voltage
37	Not used			
38	Not used			
39a	W green	UM SC, SC 6B, plug I, pin5	Sp.eff.rockersw.,pad pre	PM for sp.eff.sw.
39b	W green	Sp.eff.rockersw.,pad pre	Piano rocker sw.,pad p m	PM for piano
39c	W green	Piano rocker sw.,pad p m	Reverb rocker sw.,pad p m	PM for reverb
39d	W green	Reverb rocker sw.,pad p m	WV rocker sw.,pad p m	PM for WV
39e	W green	WV rocker sw.,pad pre	Chnl.sw.,S2 K, pad 16	PM for WV rtJlft.
40	W green	U M SC S C 6 B, Plug 1, pin 2	Sp. Eff. E F 2, plug 3, pin 22	PM for sp.eff.

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
41	W green	U M SC SUB, plug 1, pin 3	U M FS G P 1, plug 2, pin P M	P M for U M FS
42	W green	L M SC SUB, plug 1, pin 1	L M FS G P 1, plug 2, pin P M	PM for L M FS
43	W green	U M SC SC6B, plug 1, pin 1	U M env. sw.SW S, plug 1, pin 18	P M for U M env. con.
44	W green	LM SC SC3B, plug 1, pin 3	LM env. rockersw., pad p m	PM for L M env. con.
45	Not used			
46	W green	U M SC SUB, plug 1, pin 6	Generator rocker sw., pad p m	P M for gener.func.
47	W green	L M SC SUB, plug 1, pin 6	Pedal rockersw., pad p m	PM for pedals
48	Not used			
49	Not used			
50	Not used			
51	W black	Power supply PS 1, G N D	Preamp VV 2, left, plug 5, pin G	Ground (= G N D)
52	W black	Power supply PS 1, G N D	PE 13 (36), plug 7, G N D	G N D
53	W black	Power supply PS 1, G N D	LM env. cont.H K 13, term.G N D	G N D
54	W black	Power supply PS 1, G N D	Master pitch cont.term. E	On interface panel AP 11
55	W black	Power supply PS 1, G N D	Wersivoice WV 7, term. G N D 9	G N D
56	W black	Power supply PS 1, G N D	Preamp VV 2, right, plug 5, pin G	G N D
57	W black	Power supply PS 1, G N D	U M SC SC6B, plug 2, pin 23	G N D
58	W black	Power supply PS 1, G N D	Matrix board V 2, term. G N D	G N D
59	W black	Power supply PS 1, G N D	Piano PI 1, plug 3, pin G N D	G N D
60	W black	Power supply PS 1, G N D	Generator G I, plug B, pin 8	G N D
61	W black	Power supply PS 1, G N D	Sp.eff. D B, G N D (term. 14)	G N D
62	W black	Power supply PS 1, G N D	Pedal O B, G N D (term. 14)	G N D
63	W black	Power supply PS 1, G N D	Transposer T P, pad M (if twin transposer used, solder to pad B7)	G N D
64	W black	Power supply PS 1, G N D	U M envelope H K 13, term. G N D	G N D
65	W black	Power supply PS 1, G N D	Piano keyers PI 13, term. G N D	G N D
66	W black	Power supply PS 1, G N D	U M env. sw.SW S, plug t, pin 2	G N D
67	W black	Power supply PS 1, G N D	Contr.board, RP 2, pad 10 (cut off if twin transposer used).	G N D (with wire No. 309)
68	W black	Power supply PS 1, G N D	Contr.board, R P 2, pad 9	G N D
69	W black	Power supply PS 1, G N D	Sp.eff. E F 2, plug 3, pin 21	G N D

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
70	W black	Power wpply PS 1, G N D	U M F S G P 1, plug 2, pin G N D	G N D
71	W black	Preamp VV 3, left, plug t, pin G	Reverb housing bolder lug)	G N D
72	W black	Power supply PS 1, G N D	LM FS G P 1, plug 2, pin G N D	G N D
73	W black	Power supply PS 1, G N D	Stop board (solder lug)	On sp. eff. rock. sw.
74	W black	Power supply PS 1, GN D	LM SC SUB, plug2, pin 23	GN D
75	W black	Power supply PS 1, G N D	Master control, term. A volume controls	G N D
76	W black	Power supply PS 1, G N D	U M D B, G N D (term. 15)	G N D
77	W black	Power supply PS 1, G N D	L M D B, G N D (term. 10)	G N D
78	W black	Power supply PS 1, G N D	Key pop H K I, pin G N D	G N D
79	W black	Power wpply PS 1, G N D	Twin Trans. TP 2, plug t, pin G N D	G N D
80	W black	Power supply PS 1, GN D	SC sw. SW 7, plug2, pin 18	GN D
81	S green	Preamp VV 3, left, plug 1, cond. to pin F 2, shield to pin G	Reverb springs "Output"	Reverb signal return
82	S red	Preamp V V 3, left, plug 1, cond. to pin F I, shield to pin G	Reverb springs "Input"	Reverb signal feed
83	S yellow	Preamp VV 3, left, plug 1, cond. to pin A 13, shield to pin G	Interface panel AP 11, DIN connector, cond. to term. 1, shield cut off	Tape record, left
84	S brown	Preamp VV 3, left, plug I, cond. to pin E 13, shield to pin G	Interface panel AP 11, DIN connector, cond. to term. 3, shield cut off	Tape playback, left
85	Not used			
86	W red/blue	Preamp VV 2, left, plug 4, pin S 1	Channel sw. S 2 K, pad 10	L M FS right/left
87	W yel/red	Preamp VV 2, left, plug 4, pin S 2	Channel sw. S 2 K, pad 9	L M D B right/left
88	W wh/yel	Preamp V V 2, left, plug 4, pin S 3	Channel sw. S 2 K, pad 4	U M FS right/left
89	W wh/brn	Preamp VV 2, left, plug 4, pin S 4	Channel sw. S 2 K, pad 3	L IM D B right/left
90	W wh/red	Preamp VV 2, left, plug 4, pin S 5	Channel sw. S 2 K, pad 20	Sp. eff. right/left
91a	W wh/brn	Preamp V V 2, left, plug 4, pin S 6	Sw. "Pedals to WV, pad a	Pedals to Wersivoice

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
91b	W wh/brn	Prea m p VV 2, right, plug 4, pin S 6	Sw."Pedalsto WV", pad a	Pedals to Wersivoice
92	W brn/grn	Preamp VV 2, left, plug 4, pin S 7	Channel sw. S 2 K, pad 17	Wersivoice right/left
93	W wh/grn	Preamp VV 2, left, plug 4, pin S 11	Channel sw. S 2 K, pad 14	Piano right/left
94	S brown	Preamp VV 2, left, plug 5, pin E 11 (shield cut off)	Piano vol. cont.,cond.to term. S, shield to term. A	Audio, piano to left preamp
95a	W white	Preamp VV 2, right, plug 5, pin R 1	Preamp VV 2, left, plug 5, pin R 1	Ext. wire No. 95b
95b	W white	Prea m p VV 2, left, plug 5, pin R 1	Sw." Reverb I", pad a	Cont.for Reverb 1
96a	W pink	Preamp VV 2, right, plug 5, pin R 2	Preamp VV 2, left, plug 5, pin R 2	Ext. wire No. 96b
96b	W pink	Preamp VV 2, left, plug 5, pin R 2	Switch " Reverb II", US 1, pad a	Cont.for Reverb II
97	S gray	Pream p VV 3, right, plug 1,cond. to pin A 13, shield to pin G	Interface panel A P 11, DIN connector, co nd.to term. 4,shield cut off	Tape record, right
98	S white	Pream p VV t, right, plug t,cond. to pin E 13, shield to pin G	Interface panel A P 1, audio connector, cond.to term. 2, shield cut off	Tape playback,right
99	Not used			
100	W red/grn	Piano PI 1, plug 2, pin Pe	37-pin conn.pin 27	Piano sust.(swell pedal)
101	W grn/blk	Generator G 1, plug B, pin 4	37-pin conn.,pin 28	Hawaii (swell pedal)
102	Not used			
103	Not used			
104	W bn/yel	PE 13, plug 5,pin 8(PE 36: pin 7)	Pedal sw."Tuba",pad a	Cont.voltage,Tuba
105	W wh/blue	PE 13, plug 5, pin 7(PE 36: pin 6)	Pedal sw."Stringbass",pad a	Cont.voltage, Stringbass
106	W wh/red	PE 13,plug 5, pin 6(PE 36: pin 5)	Pedal sw."Bass guitar", pad a	Cont.voltage, Bass guitar
107	W wh/brn	PE 13, plug 5, pin 5(PE 36: pin 4)	Pedal sw."Trumpet",pad a	Cont.volt.Trumpet
108	W wh/yel	PE 13, plug 5,pin 4(PE 36: pin 3)	Pedal sw."Sustain short/long",pad a	Cont.voltage,long sustain
109	W wh/grn	PE 13, plug 5,pin 3(PE 36: pin 2)	Pedal sw."Sustain 0 n",pad a	Cont.voltage,short sustain

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
110	W brn/grn	PE 13,plug 5, pin 2(PE 36: pin 1)	Pedal sw."Drawbars",pad a	Cont.volt.0rawbars
111	S red	PE 13 (PE 36),plug 6,cond.to pin 9, shield cut off.	Pedal D B,cond.to term. 8, shield to G N D	Audio from bass guitar
112	S white	PE 13 (PE 36),plug 6,cond.to pin 10,shield cut off	Pedal D B,cond.to term. 10,shieid to G N D	Audio from fixed stops
113	W white	PE 13 (PE 36),plug 6, pin 11	Pedal D B, tun 1 (16')	Audio from 16'
114	W gray	PE 13 (PE 36),plug 6, pin 12	Pedal D a,term.2 (8')	Audio from 8'
115	W brown	PE 13 (PE 36),plug 6, pin 13	Pedal D B,ter m. 3 (4')	Audio from 4'
116	W yellow	PE 13 (PE 36),plug 6, pin 14	Pedal drawbars,term.4 (2')	Audio from 2'
117	W pink	PE 13 (PE 36),plug 6, pin 15	Pedal drawbars,term.5 (1')	Audio from 1'+1/2'
118	S red	PE 13 (PE 36),plug 6,cond.to pin 17,shield to pin 16	Wersivoice WV 7,cond.to pin 6, shield cut off	Pedal audio to WV
119	S red	PE 13 (PE 36),plug 6,cond.to pin 17,shield to pin 16	Prea m p V V 2, left, plug 3,cond.to pin 6, shield cut off	Predalaudio to preamp
120	S gray	Pedal DB,cond.toterm.10 "Out", shield to G N D	PE 13(PE 36),plug 6,cond.to pin 18, shield cut off	Composite pedal audio
121	W white	LM,env.H K 13, term. sust.long	L M sw."Long Sustain",pad a	Cont.forlong sustain
122	W yellow	L M env. H K 13, term. sust. med.	LM sw." Med.Sustain",pad a	Cont.for med.sust.
123	W brown	LM env. H K 13,sust.short	LM sw."ShortSustain",pad a	Cont.forshortsust.
124	W gray	LM env. H K 13 term. att.soft	L M sw. "Soft Attack", pad a	Cont.for soft attack
125	S black	Phone jack "Rhythm" on AP 11 cond.to long lug, shield to short lug	Touch sw.,Wersimaticcont.pnl.-see AM 48 0.	Remote start/stop
126	Not used			
127a	W wh/brn	Master pitch cont. AP 11 term. S.	See Fig. 2 1	Pitch control
127b	W wh/brn	See Fig. 2 1	Generator G1, plug B, pin 6	Pitch control (exten. wire No. 127a)
128	S yellow	Wersivoice WV 7,cond.to pin Out I0,shield to pin G N D 9	Preamp V V 2, left, plug 3,cond.to pin E 7,shield cut off	Audio from WV

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
129	S green	L M vol.cont.cond.to term. S shield to term. A	Wersivoice WV 7 cond.to pin 1, shield cut off	LM FS audio WV
130	S black	L M D B,cond.to pin /,shield to pin 9	Wersivoice WV 7,cond.to pin 2, shield cut off	I LM audio WV
131	S gray	U M vol.cont.cond.to term. S, shield term. A	Wersivoice WV 7,co nd.to pin 3, shield cut off	U M FS audio WV
132	S blue	U M D B,cond.to pin !,shield to pin 16	Wersivoice WV 7,cond.to pin 4, shield cut off	U M audio WV
133	S white	Sp.eff.vol.cont.cond.to term. S, shield term. A	Wersivoice WV 7,cond.to pin 5, shield cut off	Sp.eff.audio to WV
134	S brown	Piano vol.cont.cond.to term. S, shield term. A	Wersivoice WV 7,cond.to pin 7, shield cut off	Piano audio to WV
135	W yellow	Pream p V V 2,right,plug4,pin S1	Channel sw.S 2 K, pad 12	LM FS right/left
136	W brown	Pream p V V 2, right, plug4,pin S2	Channel sw.S 2 K, pad 7	LM DB right/left
137	W wh/red	Pream p V V 2, right, plug 4, pin S3	Channel sw.S 2 K, pad 6	UM FS right/left
138	W wh/blue	Pream p V V 2, right, plug 4, pin S4	Channel sw.S 2 K, pad 1	UM DB right/left
139	W wh/yel	Prea mp V V 2, right, plug 4, pin S5	Channel sw.S 2 K, pad 21	Sp.eff.right/left
140	Not used			
141	W brn/yel	Pream p V V 2,right,plug 4, pin S7	Channel sw.S 2 K, pad 18	Wersivoice right/left
142	W wh/red	Pream p V V 2, right, plug4,pin S11	Channel sw.S 2 K pad 15	Piano right/left
143	W red/blue	L M FS G P t, plug 1, pin F R	Wersivoice W V 7, pin 1c	Cont. LM FS to WV
144	W yel/red	L M FS G P 1, plug 1, pin SIN	Wersivoice WV 7, pin 2c	Cont. L M D B to WV
145	W wh/yel	U M FS, G P 1, plug 1, pin F R	Wersivoice WV 7, pin 3c	Cont. U M FS to WV
146	W wh/brn	U M FS G P 1, plug 1, pin SIN	Wersivoice WV 7, pin 4c	Cont. U M D B to WV
147	W wh/red	Sw. "Sp.eff.to WV, pad b	Wersivoice WV 7, pin 5c	Cont.sp.eff.to WV
148	i W wh/blue	Sw."Ped.to WV " pad b	Wersivoice WV 7, pin 6c	Cont.pedalsto WV
149	W wh/grn	Sw. "Piano to WV" pad b	Wersivoice WV 7, pin 7c	Co nt. piano to WV

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
150	WV yellow	Sw."Normal/Heavy",pad a	Wersivoice WV 7, pad 12	WV intensity (Heavy)
151	W brown	Sw."Normal/Soft",pad a	Wersivoice WV 7, pad 13	WV intensity (Soft)
152a	W pink	Sw."Fast/Chorale",pad a	Sw.board SN 8, plug /,pin 15	WV speed
152b	W pink	Sw."Fast/Chorale",pad a	Wersivoice WV 7, pin 4	WV speed
153	W white	Sw. "Whirl/Choir", pad a	Wersivoice WV 7, pin 15	WV mode
154	W gray	Sw."Speedshift",pad a	Wersivoice WV 7, pin 16	Speedshiftslow/fast
155	S brown	Piano vol.cont.cond.to term. S, shield to term A	Prea m p V V 2, right, plug 5,cond.to pin E II,shield cut off	Piano audiotto preamp
156	S gray	Piano keyers PI 12,4th oct.cond. to term. Out,shield to Ju	Piano PI I,plug I,cond.to pin 5, shield cut off	
157	S red	Piano keyers PI 12,3rd oct.,cond. to term. Out,shield to Ju	Piano PI /,plug 1,cond.to pin 4,shield cut off	Piano keyeraudio
158	S white	Piano keyers PI 12,2nd oct.cond. to term. Out,shield to Ju	Piano, P1 /,plug 1,cond.to pin 3,shield cut off	To piano voicing
159	S blue	Piano keyers PI 13,1stoct.,cond. to term. Out, shield to Ju	Piano, PI 1, plug 1,cond.to pin 2, shield cut off	To piano voicing
160a	W yel/blue	Generator GI,plug A, pin 5	Piano, PI 1, plug 1, pin Trig.	"Key Down"
160b	W yel/blue	Piano PI 1,plug 1, pin Trig.	Spec. effects E F I,plug 1, pin 1	"Key Down"
160c	W yel/blue	Sp.Effects EF 2, plug 1,pin 1	L IM env. H K 13, term. Perc.	"Key Down"
161	W yellow	Tremolo cont.term. A	Piano PI I,plug 1, pin "Speed"	Tremolo/Echo rate
162	W yellow	Tremolo cont.term. S	Piano PI I,plug 1, pin "Speed"	Tremolo/Echo rate
163	S brown	Piano, PI 1, plug 3;cond.to pin Out, shield to pin G N D	Piano volume cont.,cond.to term E, shield cut off	Piano audio output
164	W brown	Piano, PI 1, plug 2, pin Ki	Switch "Kinura",U S 1,pad a	Kinura
165	W red/blue	Piano, PI 1, plug 2, pin Hs	Switch "Harpichord", U S 1,pad a	Harpichord
166	W pink	Piano, PI1,plug2,pin Ho	Switch "Honky Tonk",US I,pad a	Honky Tonk
167	W white	Piano, PI 1, plug 2, pin Ce	Switch "Celeste", U S 1,pad a	Celeste
168	W gray	Piano, PI 1, plug 2, pin Pi	Switch "Piano", U S I,pad a	Piano
169	W yel/red	Piano, PI 1, plug 2, pin Ba	Switch "Banjo",U S 1,pad a	Banjo

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
170	W wh/yel	Piano, PI 1, plug 2, pin Ec	Switch "Echo", U S I, pad a	Echo
171	W wh/brn	Piano, PI 1, plug 2, pin Tr	Switch "Tremolo", U S 1, pad a	Tremolo
172	W wh/red	Piano, PI t, plug 2, pin S/L	Piano keyers PI 13, term. A	Long sustain
173	W yellow	Generator, G1, Plug A, pin 7	Switch "Del. Vibrato", U S 1, pad a	Delayed vibrato
174	W brown	Generator, G1, Plug A, pin 6	Switch "Cont. Vibrato", U S 1, pad a	Continuous vibrato
175	Not used			
176	W pink	Generator, G 1, Plug A, pin 3	Switch "Slow Vibrato", U S 1, pad a	Slow vibrato
177	W white	Generator, G 1, Plug A, pin 2	Switch "II", U S I, pad a	Vibrato II
178	W gray	Generator, G 1, Plug A, pin 1	Switch "III", point a	Vibrato III
179	W yel/blk	Generator, G 1, Plug B, pin 7	Transposer TP, point B7	
180a	W wh/yel	Generator, G 1, Plug B, pin 3	Sw. "Autoglide Up/Down", U S 1, point a	
180 b	W wh/yel	Generator, G1, Plug B, pin 3	Control " Autoglide Speed", term. A	Autoglide speed
181	W red/blue	Generator G 1, Plug B, pin 2	Sw. "Autoglide 0 n", U S 1, pad a	
182	W w h/blue	Generator, G 1, Plug B, pin 1	Contr. "A utoglide Speed", U S t, term S	Autoglide speed
183	S red	Sp. eff. drawbars, cond. to term. Out, shield to term. G N D	Spec. Eff. E F 1, plug 2, cond. to pin 16 shield cut off	Drawbar audio to special effects
184	W wh/blk	Transposer, TP pad S	Contr. board, RP 2, pad 8	Slalom control S
185	Not used			
186	W gray	U M env. H K 13, term. Att. soft	Env. sw., SW 8, Pg 1, pin 3	Soft Attack
187	W brown	L IM env. H K 13, term. Sust. short	Enc. sw., SW 8, Pg 1, pin 6	Short Sustain
188	W yellow	U M env. H K 13, term. Sust. med.	Env. sw., SW 8, Pg 1, pin 9	Medium Sustain
189	W white	L IM env. H K 13, term. Sust. long	Ennsw., SW 8, Pg 1, pin 12	Long Sustain
190	W yellow	Spec. effects, EF 2, plug 3, pin 23	Contr. board, RP 2, pad 7	Wah Wah contr. S

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
191	S green	L M volume control, cond.to term. S, shield to term. A	Pream p V V 2, left, plug 3,cond.to pin E I,shield cut off	LM fixed stop audio to preamp
192	S black	LM drawbars,cond.to term. 1, shield to term. 11	Pream p V V 2, left, plug 3,cond.to pin E Zshield cut off	LM drawbar audio to preamp
193	S gray	U M volume control, cond.to term. S, shield to term. A	Pream p V V 2, left, plug 3,cond.to pin E 3,shield cut off	LM fixed stop audio to preamp
194	S blue	U M drawbars,cond.to term. I, shield to term. 17	Pream p V V 2, left, plug 3,cond.to pin E4, shield cut off	U M drawbaraudio to preamp
195	S white	Spec. effects vol.cont.cond.to term. S, shield to term. A	Pream p V V 2, left, plug 3,cond.to pin E5, shield cut off	Spec. effects audio to preamp
196	Not used			
197	W yellow	Speneff. E F 2, plug I, pin 2	Control "Sp. Eff. Rate", term, A	
198	W wh/red	Spec. el E F 2, plug i, pin 3	&in "Variable Rate", U S I ,point a	
199	W wh/blue	Spec. eff. E F 2, plug I, pin 6	Sw. "Wah Wah Limiter", U S I,point a	
200	W wh/grn	Spec. eff. E F 2, plug 1, pin 5	Sw. "Medium Rate", U S 1,point a	
201	W wh/yel	No function - cut off!	No function - cut off!	
202	S white	Spec. eff. E F 2, plug 1,cond.to pin 8, shield to pin 7	Spec. eff.,ol.cont.,cond.to term. E, shield cut off	Audio output from special effects
203	W brown	Spec. eff. E F 2, plug 2, pin 9	Slide cont. "Wah Wah ",term . A	
204	W brown	Qeneff.E F 2, plug 2, pin 10	Slide control "Wah Wah",term.S	
205	S red	Spec. eff. EF 2, plug 2,cond.to pin II,shield cut off	L IM 0 B, Z R 4,cond.to term. 6,shield to term. 19	No function
206	S blue	Spec. eff. E F 2, plug 2, cond. To pin 12,shield cut off	L IM D B,Z R 4,cond.to term. 5,shield to term. 18	No function
207a	S gray	Spec. eff. E F 2, plug 2,cond.to pin 13, shield cut off	U M FS, G P 1, plug 2,cond.to pin Out, shield to pin G N D	L IM FS audio to spec. effects
207b	S gray	Spec. eff. E F 2, plug 3,cond.to pin 20, shield cut off	U M FS, GP 1, plug 2,cond.to pin Out, shield to pin G N D	No function
208	W pink	Spec. eff. EF 2, plug 3, pin 17	Control "Wah Wah Speed", term. A	Wah Wah speed cont.

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
209	W pink	Spec. eff. E F 2, plug 3, pin 18	Control "Wah Wah Speed", term.S	Wah Wah speed cont.
210	S gray	U M FS G P 1, plug 2,cond.to pin Out, shield to pin GND	U M vol.cont.cond.to term. E, shield cut off	L IM volume
211	W yellow	U M FS, G P 1, plug 1, pin SIN VV	Chan. sel., S 2 K, point 2	L IM D B right/left
212	W white	L IM FS, G P 1, plug 1,pin F R V V	Chan. sel., S 2 K, point 5	L IM FS right/left
213	S green	L M FS, G P 1,plug 2,cond.to pin Out, shield to pin GND	L M vol.cont.cond.to term. E, shield cut off	L M volume
214	W pink	LM FS, G P 1, plug 1, pin SIN VV	Chan. sel., S 2 K, pad 8	L M D B right/left
215	W brn/grn	L M FS, G P 1, plug 1, pin F R V V	Chan. sel., S 2 K, pad 11	LM FS right/left
216	W brown	Sw."Sp. eff.to WV", US 1, pt. b	Chan. sel.,S 2 K, pad 19	Sp. eff.right/left
217	W gray	Switch "Piano to WV ", U S I,pt. b	Chan. sel.,S 2 K, pad 13	Piano right/left
218	W brn/grn	Piano, PI 1, plug 2,pin B	Piano PI 13,term. B	
219	W wh/blk	Piano, PI 1, plug 2,pin A	Sw."Long Sustain", US I,pad a	Long piano sustain
220 thru 300		Not Used		
301	S brown	Key pop HP I,cond.to pin 01, shield to G N D	L IM D B,Z R 4,cond.to R1 (front end), cut off shield	L IM Key pop audio
302	W yel/blue	Key pop, HP 1, pin T1	L IM env. contr.,H K 13, term. Perc	
303	W yel/brn	Key pop H P 1, pin T2	L IM en c.contr,H K 13, term Perc	
304	S green	Key pop, HP I,cond.to pin 02,shield to pin G N D	L M D B, Z R 3,cond.to R 1 (front end), shield cut off	
305	W w h/brn	Key pop, H P t,pin C	Sw."Key Pop", U S 1,pad a	Cut off wire 201, See Text
306	W yel/blk	Twin trans., T P 2, plug 1, pin B7	Generator G 1, plug B, pin 7	
307	W wh/blk	Twin trans., TP 2, plug 1, pin B7	Contr. board, R P 2, pad 8	Slalom control S

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
308	W brown	Twin trans., TP 2, plug 1, pin B15	Auto acco m p.,point 15	See Fig. 21
309	W gray	Twin trans., TP 2, plug 1,pin S	Co ntr. board R P 2, pad 10	Slalom control A
310	W white	Twin trans., TP 2, plug t, pin C16	Auto acco m p.,point 16	See Fig. 21
311	W brown	Twin trans., TP 2, plug 2,pin C	Transposer, TP,pad C	
312	W yellow	Twin trans., T P 2, plug 2, pin cis	Transposer, TP, pad #	
313	W gray	Twin trans., TP 2, plug 2,pin d	Transposer,TP,pad d	
314	W white	Twin trans., TP 2, plug 2, pin dis	Transposer, TP,pad d#	
315	W pink	Twin trans., TP 2, plug 2,pin a	Transposer,TP,pad a	
316	W red/blue	Twin trans., TP 2, plug 2, pin f	Transposer, TP, pad f	
317	W wh/blue	Twin trans., TP 2, plug 2, pin ges	Transposer,TP,pad gb	
318	W wh/red	Twin trans., TP 2, plug 1, ping	Transposer,TP,pad g	
319	W wh/brn	Twin trans., TP 2, plug 1, pin as	Transposer, TP,pad ab	
320	W r/yel	Twin trans., TP 2, plug l,pin a	Transposer, TP,pad a	
321	W wh/blk	Twin trans., TP 2, plug 1, pin b	Transp oser, TP,pad bb	
322	Wye/blue	Twin trans., TP 2, plug 1, pin ces	Transposer, TP,pad b	
323	W yel/red	Aux. pwr.supply,PS 6, plug 3	LM S. C., SC 3B, plug 2, pin 22	-33 V DC
324	W yel/red	Aux. pwr.supply,PS 6, plug 3	U FA S. C., SC 6B,plug2,pin 22	-33 V D C
325	W gray	Key switch	L IA S. C., SC 3 B, plug 1, pin 12	"Read-in" cont. LM
326	W gray	Key switch	U FA S. C., SC 6 B, plug 1, pin 11	"Read-in" cont. U FA
327	W gray	Key switch	Cons. board,SW 7, plug 2, pin 17	"Read-in" cont.
328	W wh/yel	Pwr.supply,PS 2, cap. C3 (+)	Cons. board, RP 2, pad 5	24 V D C for lamps
329	W wh/pk	L FA S.C., SC 3B, plug 1, pin 10	Cons. board, R P 2, pad 6	Flasher
330	W w h/brn	LM S.C., SC 313, plug 2, pin 18	Cons. board,SW 7, plug 1, pin 1	Address AO L FA
331	W wh/blk	U FA S. C., S C 6 B, plug 2, pin 18	Cons. board, SW 7, plug 1, pin 2	Address AO U FA
332	W wh/brn	L M S. C., SC 3B, plug 2, pin 17	Contrboard,SW 7, plug l, pin 3	Address A1 L FA
333	W wh/blk	U FA S.C., S C 6 B, plug 2, pin 17	Cons. board, SW 7, plug 1, pin 4	Address A1 U FA
334	W wh/brn	L M S.C., SC 313, plug 2, pin 16	Cons. board,SW 7, plug l,pin 5	Address A2 L M
335	W w h/blk	U FA S. C., S C 6 B, plug 2, pin 16	Cons. board, SW 7, plug l, pin 6	Address A2 U FA

Wire No.	Material/Color yy=wire S=cable	Starts at: (Subunit, PC board, Terminal)	Ends at: (Subunit, PC board, Terminal)	Purpose, Remarks
336	W wh/brn	L FA &C, SC 3B, plug 2, pin 15	Cons. board, SW 7, plug 1, pin 7	Address A 3 L M
337	W wh/blk	U FA S.C., SC 613, plug 2, pin 15	Cons. board, SW 7, plug 1, pin 8	Address A3 U FA
338	W wh/brn	L M ST, SC 3 B, plug 2, pin 14	Cons. board SW 7, plug 1, pin 9	Address A4 L FA
339	W wh/blk	U FA S.C., S C 6 B, plug 1, pin 14	Cons. board, SW 7, plug 1, pin 10	Address A4 U FA
340	W wh/brn	LM S. C., S C 3 B, plug 2, pin 13	Cons. board, SW 7, plug t, pin 11	Address A5 L FA
341	W w h/blk	U FA S.C., SC 613, plug 2, pin 13	Cons. board, SW 7, plug 1, pin 12	Address A5 U FA
342	W yel/blue	L FA S.C., S C 3 B, plug 1, pin 8	Cons. board, SW 7, plug 2, pin 14	LM memory
343	W brown	U FA S. C., S C 6 B, plug t, pin 12	Cons. board, SW 7, plug 2, pin 15	U FA clock
344	W white	L FA S.C, SC 3B, plug 1, pin 12	Contr.board, SW 7, plug 2, pin 16	L FA clock
345	W w h/red	L M SX, SC 3 B, plug 1, pin 9	Cons. board, SW 7, plug 2, pin 19	L FA cancel
346	W wh/brn	U FA S.C., SC 68, plug 1, pin 9	Cons. board, SW 7, plug 2, pin 20	U FA cancel
347	W white	Left prea m p VV 3, pin R A	Right pream p, VV 3, pin R A	Reverb distribution
348	W brown	Left prea mp VV 3, pin R E	Right preamp, V V 3, pin R E	Reverb distribution

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