Hammond® X-66

Connecting X-66

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Connecting the Hammond X-66 Console.

1. Forewords and Purpose .

As owner of an X-66 Console, you are facing several possibilities of connecting your Hammond X-66 to an audio system.

The simplest way is to connect your X-66 to one (or two) original Hammond tone-cabinet TC-1277 with genuine 7-pin cable, adjust the input selector of TC-1277 to your favorite listening level and just play. That's it.

For those who are happy with this solution developed in the 60's, there is no need to go any further.

However for those who don't appreciate too much the sound reproduction of the bulky TC-1277, today's audio technology offers other interesting alternatives that will be summarized in this chapter.

Connecting your X-66 console to an external audio system provides a lot of evident advantages that can never be obtained with the original Hammond TC-1277.

Some examples:

- adjusting the frequency response to your own hearing preferences
- adjusting the overall sound to the room conditions with equalizer
- playing silently with headphones
- minimizing the residual hum and noise, hiss.. by levelling the faders
- adding a Leslie cabinet
- easiness of replacing elements in case of failure
- adding more recent devices such as Leslie simulators or the like
- adding bass enhancer and/or sub-bass channel
- getting a stereo effect
- getting a real powerful audio system for those playing on stage
- feeding P.A. systems

The purpose of this chapter is to provide several ways of connecting the X-66 console without the TC-1277 tone cabinet. As owner of both audio systems, I found that it was interesting to write something about that.

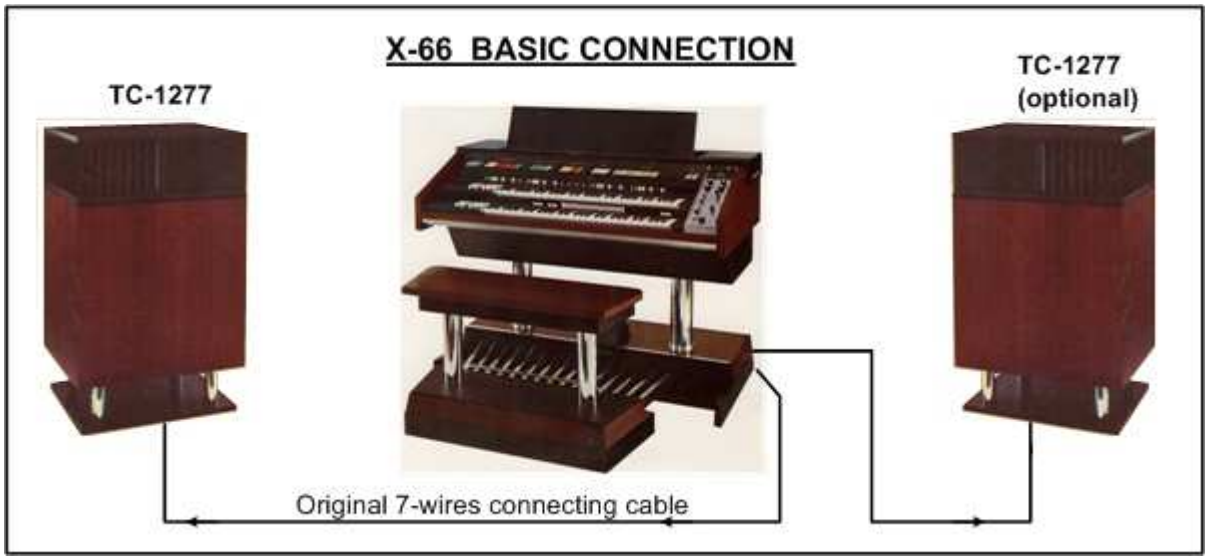
2. X-66 ORIGINAL SETTING.

There is no so much to say about the original connection of X-66 to TC-1277.

Nothing can be changed.

Just plug the 7-wires connecting cable, adjust the input level of the TC-1277 to your listening level, switch ON the system and play.

That's exactly how it was developed by Jim McLin in the 60's.



3. BASIC SETUP without TC-1277.

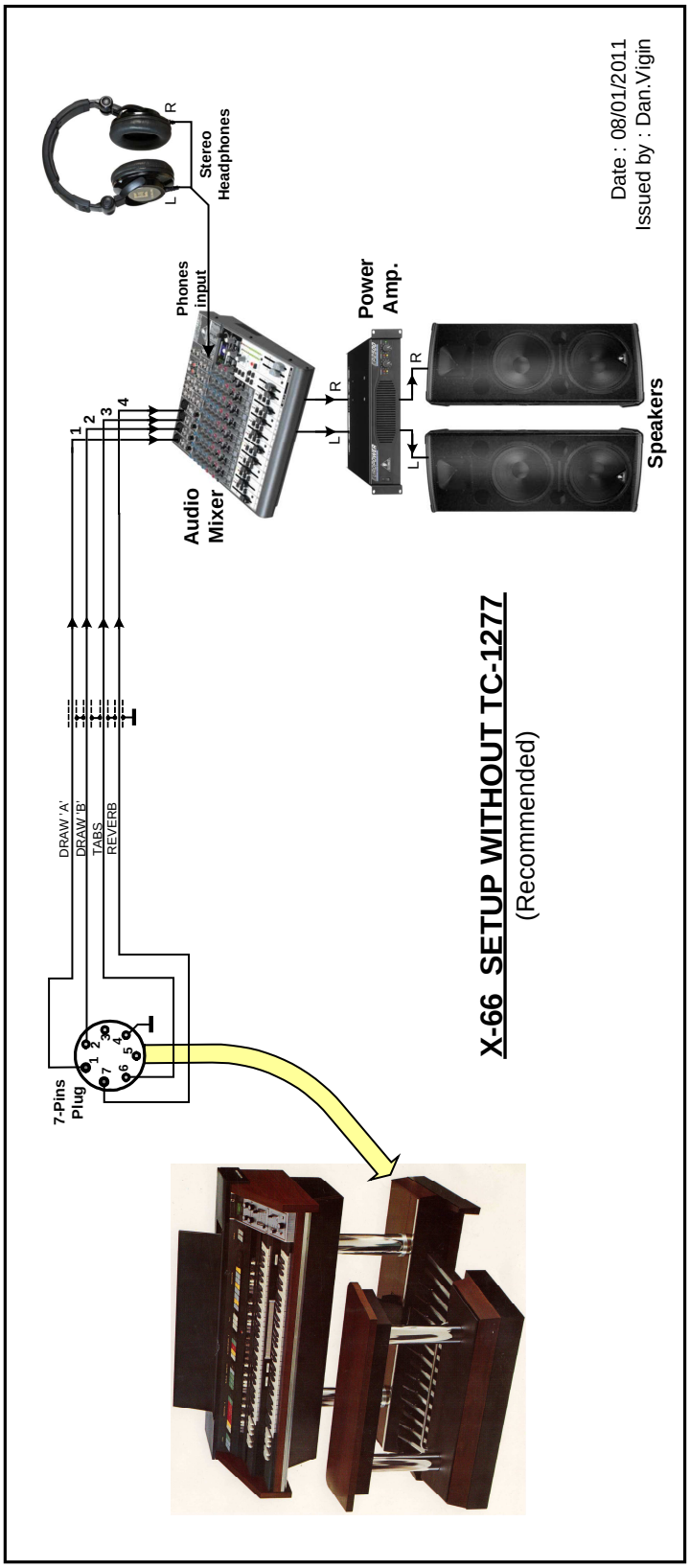
In this configuration, the TC-1277 has been discarded and the X-66 console is connected directly to the audio mixer with a special cable equipped on one end with a 7-pin plug and on the other end with four ¼ " TS connector (6.3mm jack).

It is also possible to replace the four TS plugs by four XLR connectors (male).
Since signals coming from X-66 are unbalanced then pin 1 and pin 3 of XLR connectors have to be bridged. See Page 23 for cabling.

Generally, the XLR connectors are used at Microphone input sockets of the audio mixing table.

The level of each channel from X-66 will be adjusted with the input faders according to the user's preferences.
Quite basic setup, easy to implement and provides already flexible results.

This configuration is also interesting for organists who want to play 'silently'.
Each audio mixer can accommodate one headphones set.
Evidently, the power amplifier behind it will be switched OFF.


Date : 08/01/2011
Issued by : Dan.Vigin
Stereo Headphones
Phones input
Audio Mixer
Power Amp.
Speakers
DRAW 'A'
DRAW 'B'
TABS
REVERB
7-Pins Plug
X-66 SETUP WITHOUT TC-1277
(Recommended)

4. PAN-POTS settings.

Special attention should be put to the Drawbar 'A' and Drawbar 'B' channels coming from X-66. The signals from those two channels are identical. When connected to the TC-1277 cabinet, due to the orientation of the speakers inside TC-1277, it provides a kind of "spacial effect".
Furthermore, this effect is reinforced when the 'Treble Vibratos' are in use.

Today's audio mixers are all featured with PAN POTS (1). To understand the function of Pan-Pot, it is advisable to remember the exact function of this feature.

Briefly said, a pan pot enables a mono-phonic input signal to be positioned where desired between the stereo loudspeakers. When the Pan knob (see hereunder) is in the center position, there is no attenuation or amplification between the input and output. When the control is turned away from the center position, the signal in one channel will be amplified more than the other.

Channel 1 = Drawbar 'A' and Channel 2 = Drawbar 'B' Photo: Paco de la Rosa

In order to refind the 'spacial' effect as with TC-1277, it is then strongly recommended to set the Drawbar 'A' channel to far Left (as shown here above) and the Drawbar 'B' to far Right ! If positioned in the center, there will be no tonal relief, just like two MONO channels operating in 'parallel'.
However, based on functional tests, it appears that all mixing tables are not designed under the same rules and it may happen that Pan-Pots have to be set just in opposite way as shown here above (i.e. Chan.1 to far Right and Chan.2 to far Left).
Just try it. If set in the wrong way the phases of both channels will cancel each others and no sound will be simply heard in the speakers.
Reverse them and correct setting is achieved.
(1) = PANoramic POTentiometer

5. BASIC SETUP with Bass enhancer unit.

Refer to drawing on the next page.

This connecting diagram is similar to the previous one. It only includes one additional BASS Enhancer unit providing a more 'groovy sound' appreciated by B3 players or Jazz players. It's just a matter of taste.

Full description of this Bass Enhancer unit can be found on the website www.hammondx66.cjb.ne .

As shown on the drawing, a 'fifth' channel, called Bass Channel, is derived from the Drawbar 'A' and ' TABs ' (or Orchestral) channels and is linked directly to Chan.5 of the audio mixer.

Here again, the Bass level can be adjusted with the input fader #5 and is left to user's discretion.

To be noted that for this particular channel, the position of the equalizer settings requires some attention in order to minimize residual background hum and noise.

More details as concerning overall settings per channel will be provided later on.

X-66 Connecting with optional Bass Enhancer Unit
Date : 08/01/2011
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Audio Mixer
Power Amp.
Speakers
Bass Channel
BASS ENHANCER UNIT
Recovery Preamp
Bass Chan. Output
LPF
80 Hz
Low Pass Filter
Bass Level
+24Vdc
AC Mains Adapter
230 V 50 Hz
DRAW 'A'
DRAW 'B'
TABS
REVERB
7-Pins Plug
WHT
RED
YEL
GND
BLU
VIO
HAMMOND X-66 CONSOLE

6. BASIC SETUP with Bass enhancer unit and SubWoofer channel.

Refer to drawing on the next page.

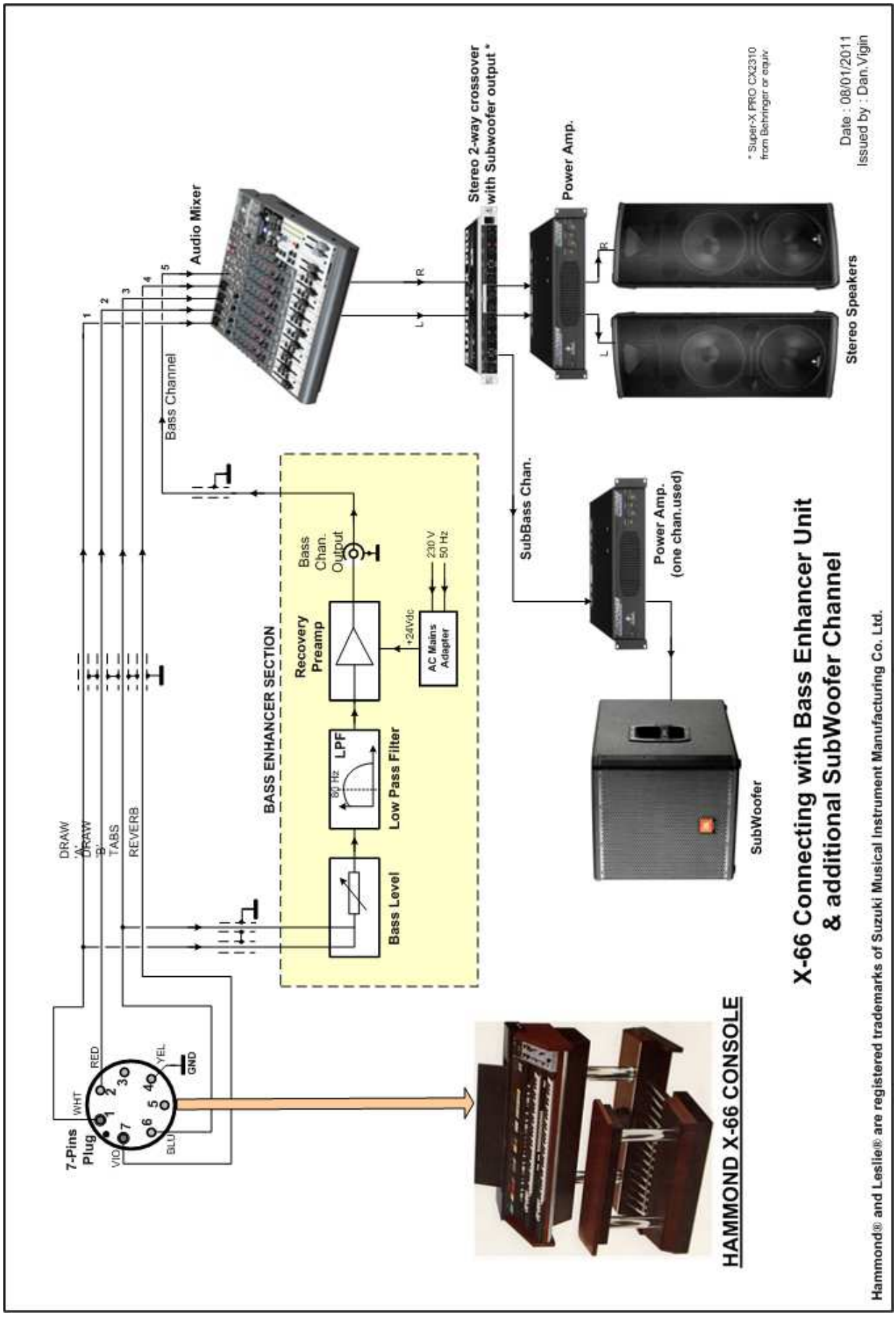
This next drawing is just a variation of the preceding one.

With this configuration, a third power amplifier is added with its Subwoofer enclosure.(2)

One active 2-way Stereo crossover with subwoofer output (as Super-X PRO CX2310 from Behringer) is inserted between the main outputs of the audio mixer and the power amplifier.

This crossover unit provides a 'SubBass' channel which drives in turn an additional power amplifier and passive subwoofer cabinet.

(2) To be honest this variant is not yet experimented up to now but will be hopefully done very soon.


X-66 Connecting with Bass Enhancer Unit
& additional SubWoofer Channel
HAMMOND X-66 CONSOLE
7-Pins Plug
WHT
RED
YEL
GND
VIO
BLU
DRAW 'A'
DRAW 'B'
TABS
REVERB
BASS ENHANCER SECTION
Bass Level
Low Pass Filter
80 Hz
LPF
Recovery Preamp
Bass Chan. Output
+24Vdc
AC Mains Adapter
230 V 50 Hz
Bass Channel
Audio Mixer
Stereo 2-way crossover with Subwoofer output *
* Super-X PRO CX2310 from Behringer or equiv.
Power Amp.
Stereo Speakers
SubBass Chan.
Power Amp. (one chan.used)
SubWoofer
Date : 08/01/2011
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7. SETUP with Leslie 147 channel.

This configuration allows connecting one Leslie 147 cabinet to the audio mixer on top of the basic setup without TC-1277.

Most of semi-pro audio mixers are equipped with ' SUB Channels ' ouputs that provides adequate output signals to drive the audio input of a Leslie 147.

Each X-66 channel can be assigned to SUB output of the audio mixer. In practice, since Drawbar 'A' and Drawbar 'B' are identical, there is no reason to assign both channels to SUB output. In my case, only the Drawbar 'B' was assigned to SUB. TABS channel (carrying Pedal Bass signals) needs also to be present at SUB output as well as Reverb if needed.

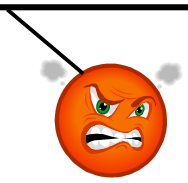
Since Leslie 147 cabinet is based on Monophonic concept only Left SUB output is connected and only Left output fader is operating.

The benefit of this configuration is to provide a full separation between the output level of 'let's call it' static system (i.e. power amp. + 2 speakers) and the rotary Leslie 147 speaker system so that the adequate tonal balance can be achieved.

Combination of both static speakers and Doppler effect provided by the Leslie cabinet has been always, to my opinion, the best sounding configuration.

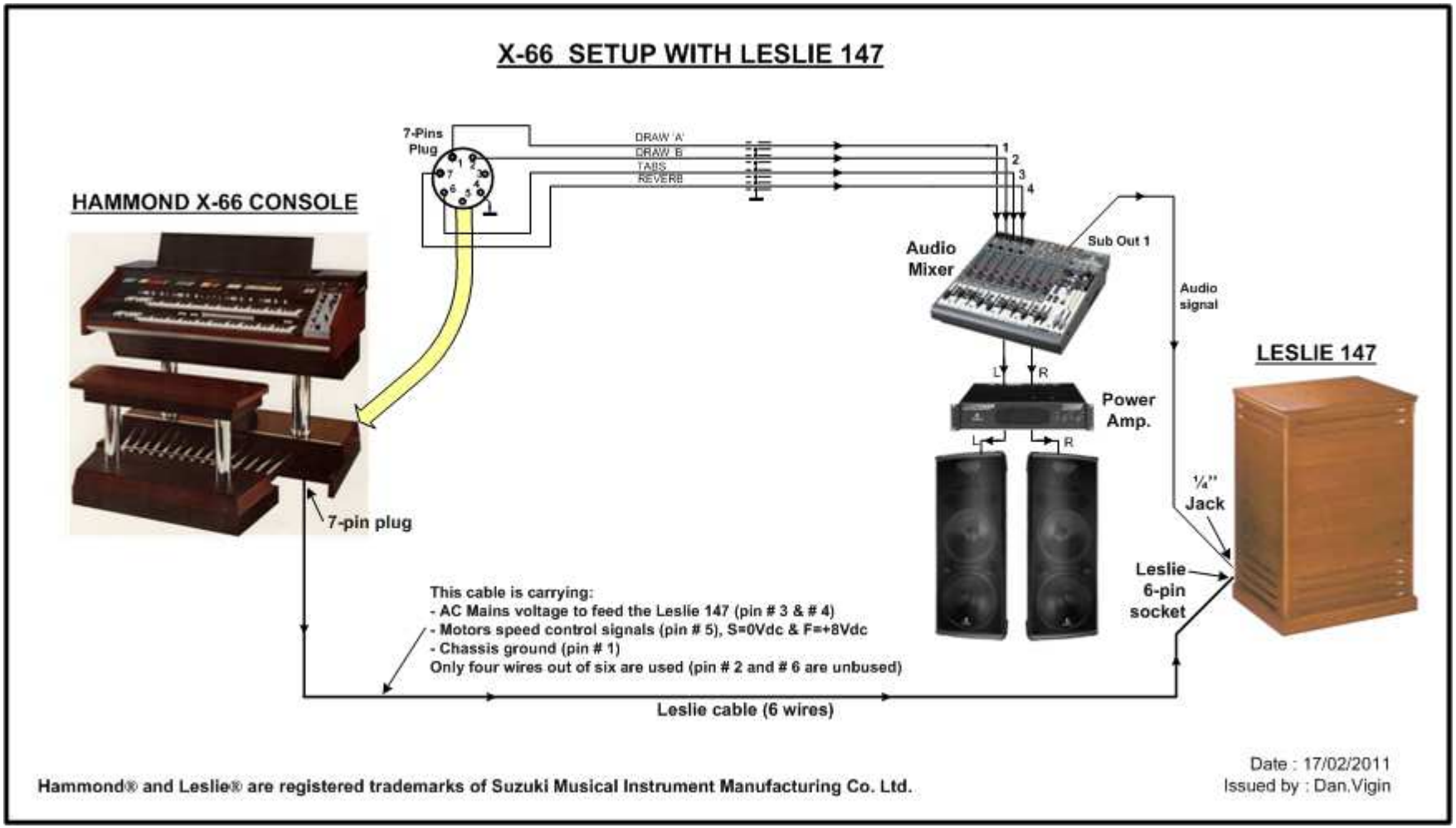
Addition of Leslie 147 with X-66 console is not so simple as it looks and requires other intensive modifications to be performed by a qualified technician. See details on the next pages.

WARNING : by modifying the wirings at both X-66 and Leslie 147 sides will render your system 'customized' and will not fit anymore with the original cabling.
This has to be taken into serious consideration for evident safety regulations reasons in case of reselling f.i. Remember that pin #2 and pin #5 of original Leslie 147 inlet is carrying also AC Mains to activate the Fast/Slow relay.



Adequate modifications are required at three levels:

- at the X-66 console
- at connecting cable between X-66 and Leslie 147
- at the Leslie 147 itself


X-66 SETUP WITH LESLIE 147
HAMMOND X-66 CONSOLE
7-Pins Plug
DRAW 'A'
DRAW 'B'
TABS
REVERB
1
2
3
4
Audio Mixer
Sub Out 1
Audio signal
LESLIE 147
L
R
Power Amp.
L
R
1/4" Jack
Leslie 6-pin socket
7-pin plug
This cable is carrying:
- AC Mains voltage to feed the Leslie 147 (pin # 3 & # 4)
- Motors speed control signals (pin # 5), S=0Vdc & F=+8Vdc
- Chassis ground (pin # 1)
Only four wires out of six are used (pin # 2 and # 6 are unbused)
Leslie cable (6 wires)
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7.1. Adaptation at X-66 Console.

One of the two 7-pin outlets has to be devoted to feed the Leslie cabinet. In other terms, one 7-pin outlet of X-66 has to be rewired to fit with the input wiring of the Leslie 147 as shown on the next drawing.

Technically spoken, it is not complicated to rewire this outlet but again this has to be performed by a qualified technician who knows what he is doing. Don't forget that this outlet is carrying AC Mains. Any error at that level could be really harmful !

It's just a matter of rewiring this 7-pin outlet to match with the 6-pin inlet of the Leslie 147. As shown on the drawing, only four wires are really effective :

- two for AC Mains
- one for ground connection
- one for Fast/Slow command

In this configuration, the audio link is not needed since this audio signal is provided by the SUB OUT 1 of the audio mixer.

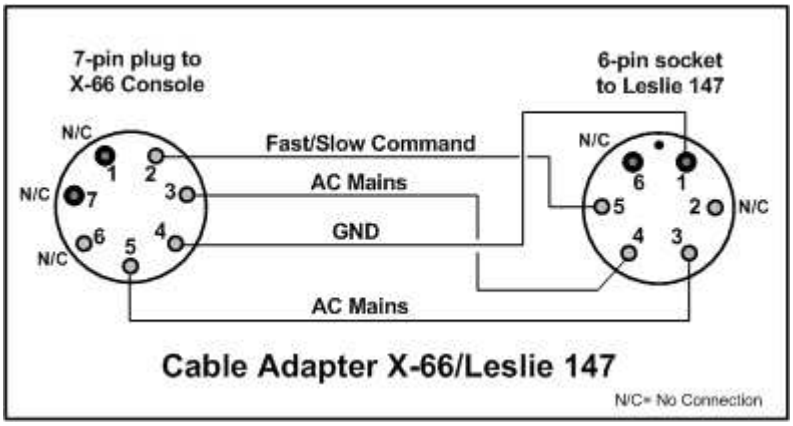
A few words on the Fast/Slow command. It is quite easy to pick up a +8 Vdc voltage somewhere in the X-66 console (from + 28 Vdc f.i. via a basic bridge of resistors).

In my case, one Hamptone module SSR-122 has been integrated in the Leslie 147 chassis to switch the speed of the motors. By injecting a + 8Vdc, it goes to FAST, with 0 Vdc, it switches to SLOW. This is at Leslie 147 end.

At X-66 end, switching this voltage from + 8 Vdc to 0 Vdc or vice versa can be done in several ways: micro-switch installed at swell pedal level, half-moon Leslie tremolo switch installed on board, foot-switch, etc...

7.2. Cable Adapter.

After having rewired the 7-pin outlet of the X-66, then a 'matching cable' or cable adapter has to be also rewired accordingly. Hereunder is the wiring diagram.

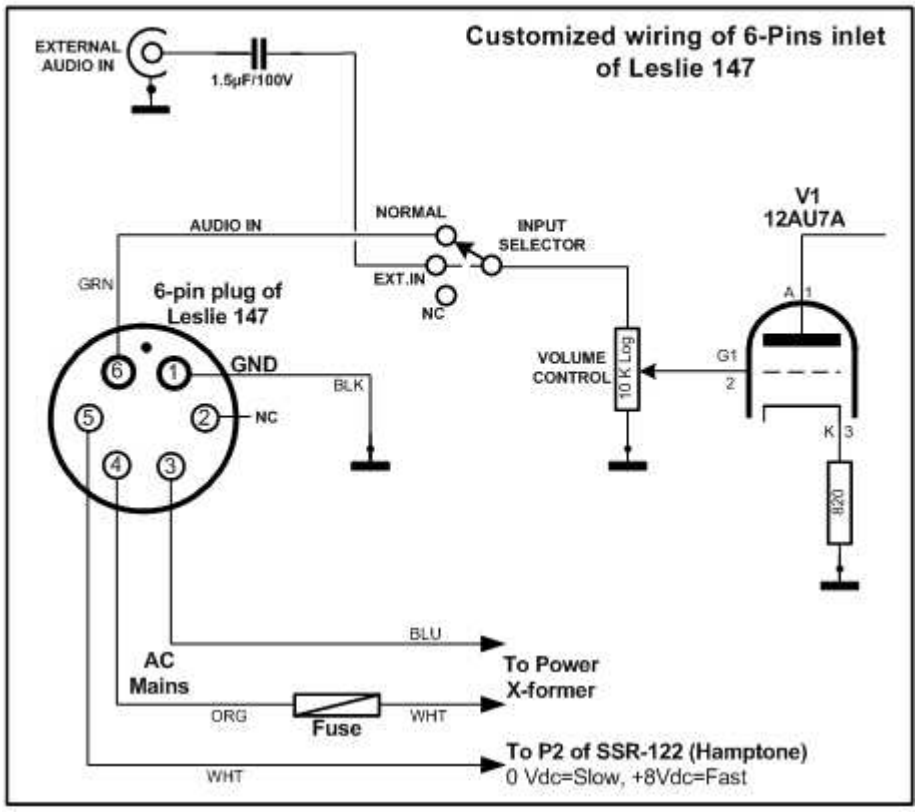


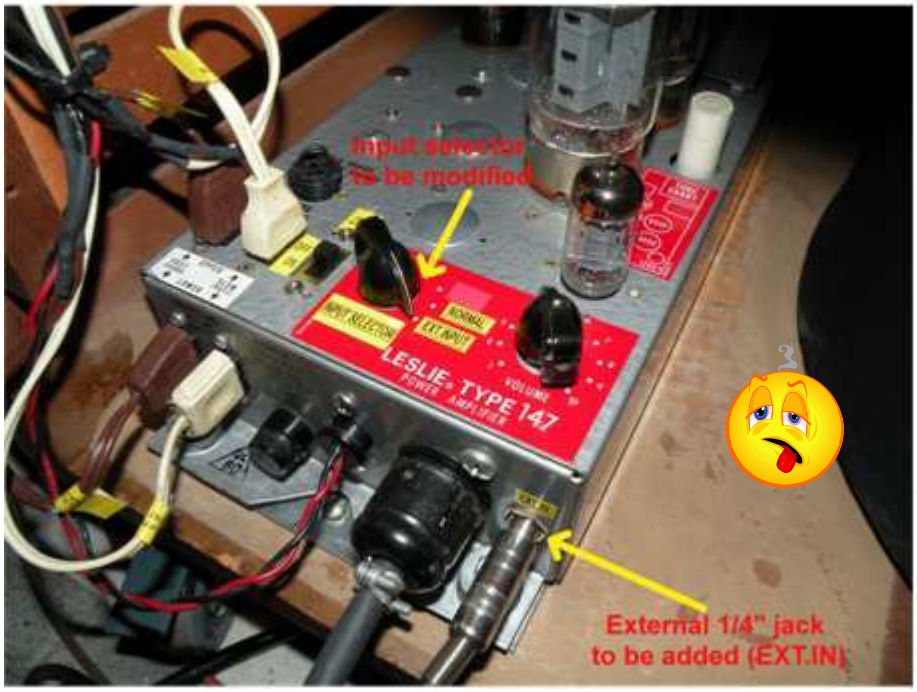
There is no so much to tell about this cable adapter except to 'double-check' in order to avoid any wiring mistake.

7.3. Leslie 147 adaptation.

The chassis of Leslie 147 also requires modifications and has to be rewired as shown the drawing hereunder. A hole has to be drilled near the 6-pin inlet (see picture) to install a ¼" jack socket called 'EXT.IN' . The input selector will be set to 'EXT.IN' i.s.o. 'NORMAL' that becomes useless. Since this input is directly linked to grid G1 of V1, one 1.5 µF capacitor is inserted to avoid any impact of DC voltage at G1.

Internal Modifications of Leslie 147

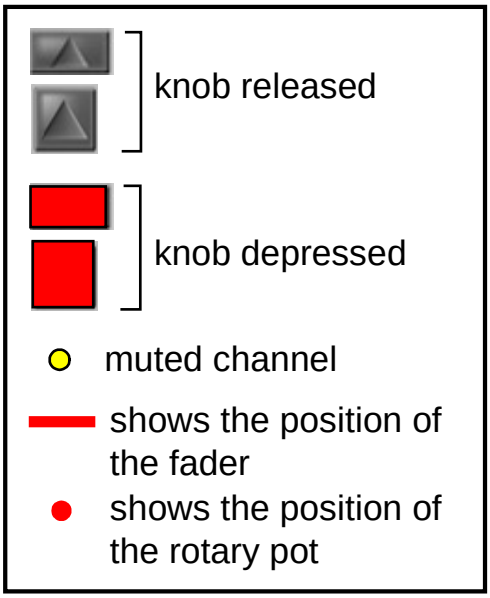




8. Audio mixer close-up with Leslie 147. **Appendix #1**

Refer to the Appendix #1. This drawing exhibits a close-up picture of the settings of my own mixing table with the Leslie 147 configuration.

The exact position of the knobs are highlighted in red colour as follows:



This configuration provides two audio signals at MAIN OUT in order to drive an external power amplifier connected to two speakers. Let's call it " Static channels ".

The signal at SUB OUT 1 output is linked to the 'EXT.IN' connector of the Leslie 147 as shown on previous drawing.
Again, a special attention has to be paid to the position of the Pan-Pot knobs in the DRAW 'A' and DRAW 'B' channels as indicated beforehand.
The other settings purely depend on user's preferences.

This picture also provides connections of several external equipments (electronic drum., expanders, bass enhancer, etc ...).

Remember that correct settings of an audio mixer takes time if one wants to achieve the best compromise between the desired output level and the unavoidable residual background noise. Take the benefit of the built-in equalizers that are really helpful on that matter.

Note: it has been always a good basic practice to switch ON all equipment before switching ON the power amplifier. Just do the reverse way when switching OFF: firstly switch OFF the power amplifier and later on all the other equipment. Since Leslie 147 is using vacuum tubes, it is therefore not concerned by this basic practice.

9. BASIC SETUP with Leslie Simulator.

It has to be recognized that adaptation of an original Leslie 147 to the X-66 Console is not so easy and required a technical skill in electronic musical instruments to perform entailed modifications.

On top of that, certain precautions have to be also taken into consideration to avoid ground loop problems. When looking the X-66 setup with Leslie 147, we can identify at once the classic 'ground loop' scheme favourable to generate hum. After many trials and listening tests, at the end, results became quite satisfactory, however believe my experience on the matter, it was not so evident.
Only recommended for qualified technicians.

To my opinion, the next setup with Leslie simulator is much more advisable because no modification is needed and it can be installed in a few minutes by anyone.
On top of that, listening results are excellent (again a personal opinion).
The Leslie simulation effect is really there and while staying personally a convinced fan of original Leslie's, I have to admit that listening results with the 'Ventilator' unit developed by Neo-Instruments are positively surprising and perfectly fit with the X-66 console. My favorite X-66 setup up to now. See also: http://www.neo-instruments.de/

The negative points found with 'Ventilator' is that this unit is not provided with ON/OFF switch on the rear panel and the 'foot-switches' (initially designed for guitar players use) are rather 'clunky' and not adapted for Hammond players.

Photo hereunder shows the 'Ventilator' unit in the center.

The X-66 setup with Leslie simulator is provided on the next page.

X-66 SETUP WITH LESLIE SIMULATOR
HAMMOND X-66 CONSOLE
7-Pins Plug
DRAW 'A'
DRAW 'B'
TABS
REVERB
Audio Mixer
To AUX RETURN L & R
From AUX SEND
OUT-R
OUT-L
IN
'Ventilator' Neo-Instruments
Power Amp.
Date : 21/02/2011
Issued by : Dan.Vigin
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Audio mixer close-up with Leslie simulator. **Appendix #2**

Refer to Appendix #2.

Connecting the 'Ventilator' to the audio mixing table is rather easy.
In my case, XENYX 2222 FX of Behringer (see picture on the covering page) is used .
Many connecting variations are possible.

Like with Leslie 147 setting, it is up to the user to decide to route through the 'Ventilator' unit the desired channels for which ,let's call it, the *pseudo* rotary Leslie effect is wished. Of course, in this configuration SUB channels settings as for Leslie 147 are no more considered.

By default, the input of the 'Ventilator' is MONO while the output signals are STEREO.

With this audio mixer, it is quite possible to route entirely the different channels through the 'Ventilator' input. This way of connecting has been tried, it works without problem but has discarded at once because, as explained earlier, the pleasing combination ' static sound ' and ' rotary sound ' is so lost. Again, it's my personal feeling.

Since the objective is to keep a full monitoring of both 'Static and 'Rotary', the connections were done as follows:

- The AUX SEND OUT "1" outlet is connected to the Input of 'Ventilator'.

- Both L & R output signals from 'Ventilator' are connected to STEREO AUX RETURNS L & R of the audio mixer. That's it for connecting.

The next action is to the assign the level of X-66 channels being routed through 'Ventilator' with each concerned SEND AUX '1' knob (middle row on next drawing), set them in 'mid' position just to start with. Afterwards, adjust the level of the AUX SENDS '1' knob (under the FX display on the right side) which operates as a master volume for the signals sent to the 'Ventilator'.

Lastly, increase by about same amount the position of the STEREO AUX RETURNS '1' and overall settings are completed.

This being done, perform the fine tuning that fits to your preferences and find the best compromise to minimize the ratio 'residual noise' and listening level.

As already stated, the proper balance between 'static' and 'rotary' channels requires some trials as well.

Settings of knobs of 'Ventilator' unit are fully described in the user's manual and again purely depends on the musician expectations.

It is also possible to insert this Leslie simulator effect through other routes of the audio mixer (i.e. via Post & Pre input faders of AUX 2, AUX 3 or FX..).
The connecting way explained here above is simple and provides excellent sounding results. Of course, anyone is free to try other possibilities.

10. Conclusions.

Most relevant ways of connecting the Hammond X-66 for home use have been reviewed. It exists probably some other possibilities for studio or stage applications.

Needless to say that, based on my numerous tests, my preferred option goes without any doubt to the 'Ventilator' setting that in combination with static speakers does provide to my opinion the most exciting Hammond X-66 sound reproduction.

Last but not least: setting with 'Ventilator' also offers two other interesting features that merit some attention:

- ' Leslie effect ' is now available also via the headphones set of the audio mixer. Interesting for silent players.

- ' Leslie effect ' can be routed from the audio mixer directly to P.A. system avoiding so delicate and laborious positioning of pick-up microphones near the Leslie cabinet.

Hope having been some help.

Dan. Vigin

Encl.: Audio connections

AUDIO CONNECTIONS