Hammond® X-66

4-Channel MIDI Distribution

by Dan.Vigin

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4-Channel MIDI Distribution.

1. Forewords and Purpose .

This 4-Channel Distribution system has been initially elaborated for my 'midified' Hammond X-66 console while it can be perfectly used with any other keyboard equipped with one MIDI OUT socket.

This type of MIDI distribution is more advisable than connecting 'in series' several MIDI instruments. When more than two MIDI instruments are cascaded the transfer delay starts to become slightly audible.

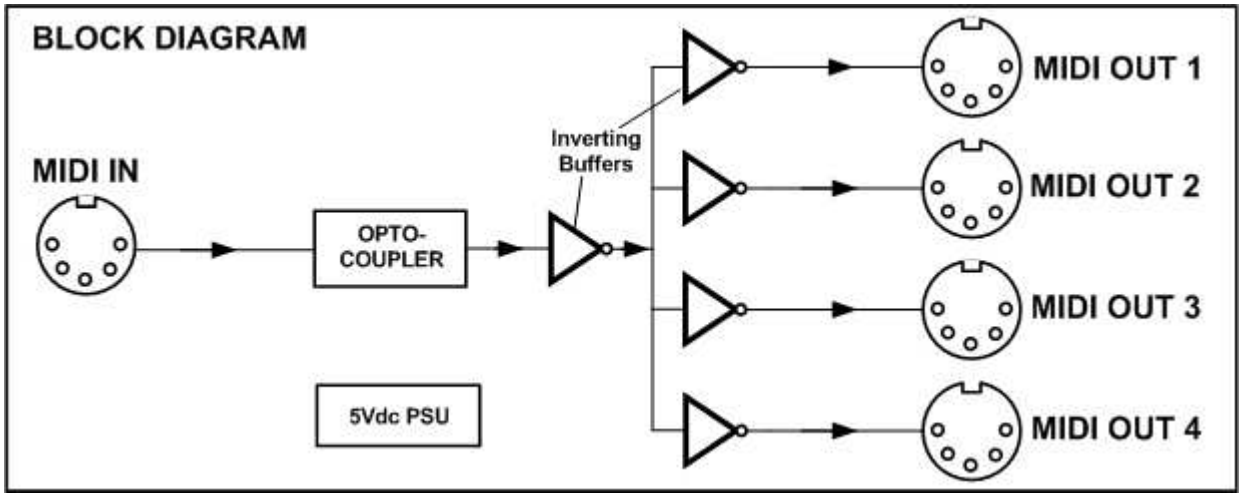
In other terms, when playing a key, the response is no more instantaneous.

With this MIDI distribution addon, this problem is totally resolved.

The purpose is to simply duplicate one MIDI OUT channel into four identical MIDI OUT channels without any signal degradation. It assures then the **MIDI Thru** function.

2. Technical description.

The realization of this MIDI distribution is rather simple and only uses commercial grade components that can be found in any electronic shop.



Optocoupler.

The MIDI input is connected directly to an optocoupler. The role of this optocoupler is to provide a total galvanic isolation between the output of the (master) keyboard and the other instruments to be connected.

The purpose is to avoid any undesired 'ground loop' even when multiple MIDI equipments are connected.

Resistor R1 will limit the current of the LED to about 15 mAdc and diode D1 is protecting the optocoupler in case of wrong polarity of the MIDI cable.

MIDI signals are available at pin #5 and sent to the first inverting buffer.

MIDI output stage.

The concept of the MIDI output stage is the same as those found in the majority of equipment featured with MIDI functions.

Only one single 74HCT14 IC is used. This IC is composed of 6 inverting buffers with Schmitt-trigger action. The role of this IC is to transform slow changing input signals into sharply defined, jitter-free output.

See datasheets for details on :
http://www.nxp.com/documents/data_sheet/74HC_HCT14.pdf

Signals collected from the optocoupler are routed directly to the first inverting buffer IC-1A. The buffered and inverted signals are feeding directly the 5 remaining output buffers.

In turn, those inverting buffers are connected directly to pin #5 of MIDI output sockets through one resistor of 220 ohms.

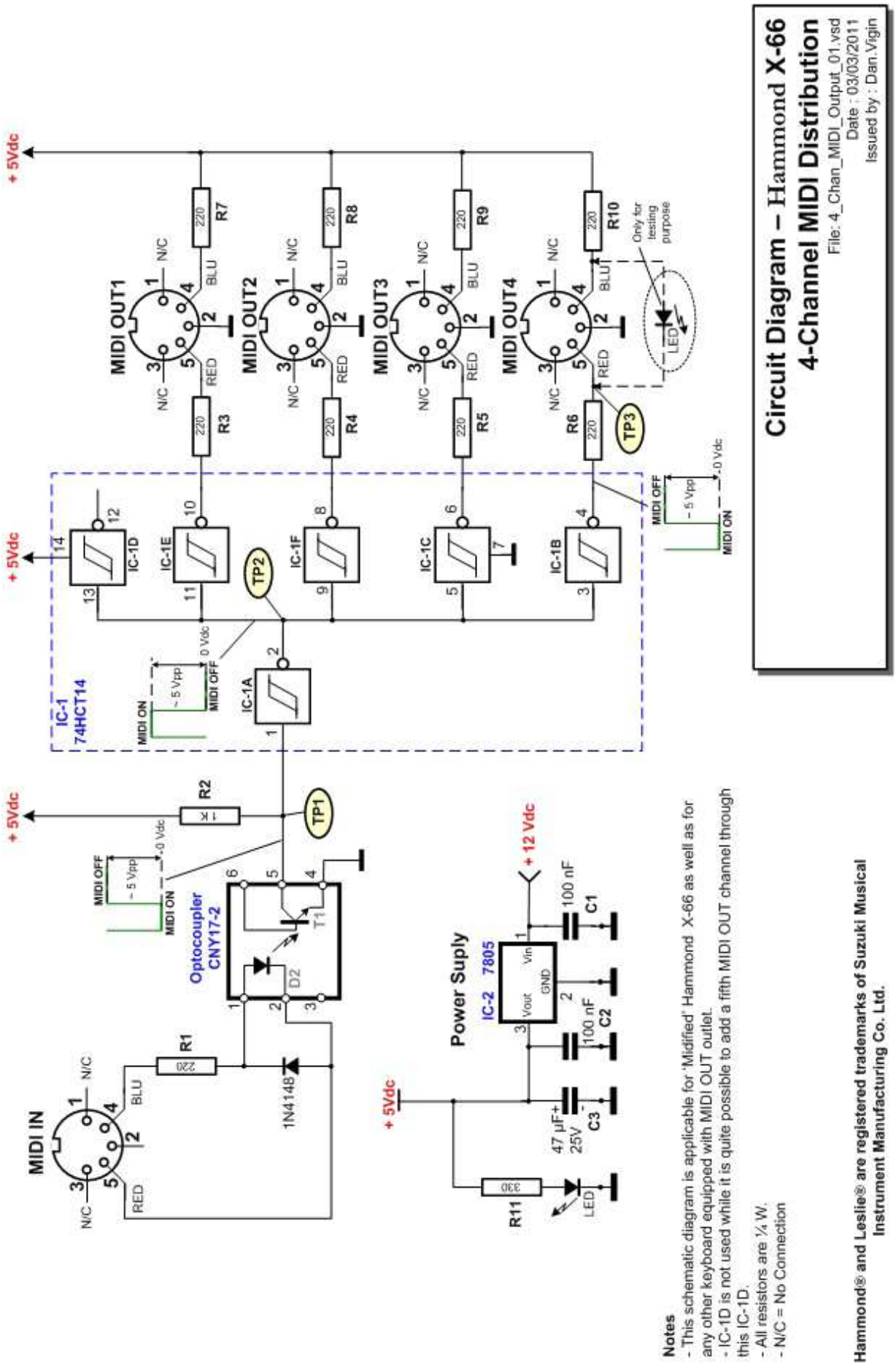
In this case, type 74HCT14 is used (low consumption and faster response) while other similar types like 7414 or 74LS14 could also operate for this application.

Cabling of MIDI OUT socket meets the MIDI standard:

- pin # 4 of DIN connector is connected to +5Vdc voltage via one 220 ohms resistor.

- pin # 5 of DIN connector will transfer the MIDI signals to the next MIDI device also via one 220 ohms resistor.

The four buffer stages are identical. While not in use, the input (pin #13) of IC-1D has to be connected somewhere. So, if a fifth MIDI output is desired, simply wire this remaining buffer stage like the others.


Circuit Diagram – Hammond X-66
4-Channel MIDI Distribution
File: 4_Chan_MIDI_Output_01.vsd
Date : 03/03/2011
Issued by : Dan.Vigin
MIDI IN
MIDI OUT1
MIDI OUT2
MIDI OUT3
MIDI OUT4
IC-1
74HCT14
IC-1A
IC-1B
IC-1C
IC-1D
IC-1E
IC-1F
Optocoupler
CNY17-2
T1
D2
1N4148
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
TP1
TP2
TP3
Power Suply
IC-2 7805
Vin
Vout
GND
C1
C2
C3
100 nF
100 nF
47 µF+
25V
LED
Only for testing purpose
MIDI ON
MIDI OFF
~ 5 Vpp
0 Vdc
+ 5Vdc
+ 12 Vdc
N/C
BLU
RED
Notes
- This schematic diagram is applicable for 'Midified' Hammond X-66 as well as for any other keyboard equipped with MIDI OUT outlet.
- IC-1D is not used while it is quite possible to add a fifth MIDI OUT channel through this IC-1D.
- All resistors are ¼ W.
- N/C = No Connection
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Power Supply.

Needless to say that this circuit must be powered and requires regulated + 5Vdc voltage to operate. A basic regulated +5Vdc IC (LM7805) is used on purpose and must support a current of about 100 mAdc when all MIDI output are connected.

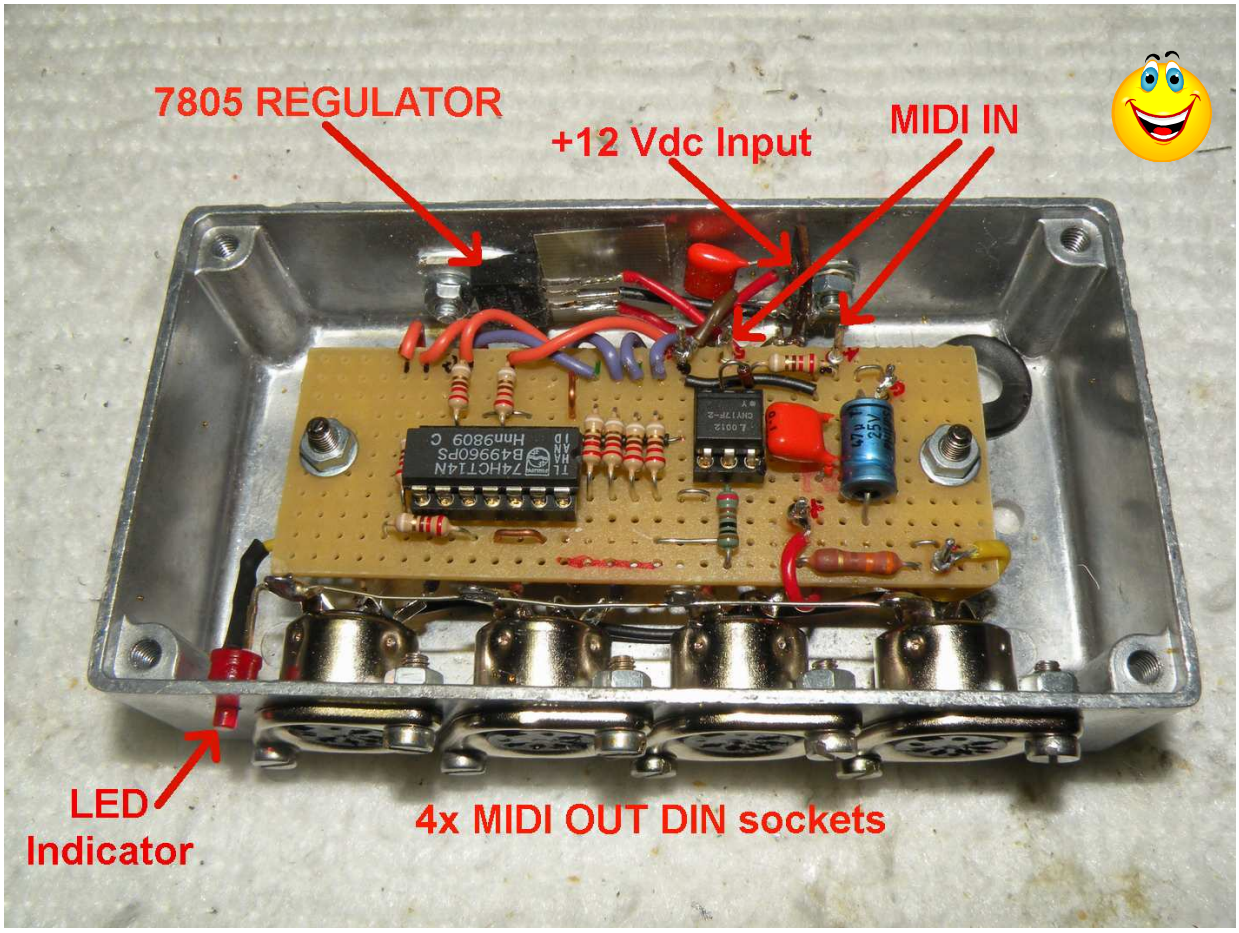
The incoming voltage +12 Vdc (or + 15 Vdc) can be picked up from the Hammond X-66 PSU.

4. Realization.

The whole circuit has been wired on a perforated bakelite board since the simplicity of this circuit does not justify (to my opinion) to design a special PCB.
IC's are mounted on sockets for easiness of replacement in case of problem.

As shown on the picture here under, the circuit is installed in a small aluminium die-cast enclosure. The four MIDI OUT sockets are on the front with one LED indicator.

The LM7805 regulator is fixed on the rear side.



In my case, since this MIDI distribution box is integrated in my X-66 console, the MIDI IN socket has been eliminated because MIDI IN wires are directly linked to the MIDI converter CTM-64 inside the X-66 console. Those cables (MIDI IN signals and +12Vdc) are routed via a round hole located on the top-right corner of the enclosure.

5. Functional Tests.

With error-free wiring, this unit should operate normally when switching ON from the first time. Nevertheless, in case of problem, the following testing method can be applied if any.

MIDI OFF condition: if no signal is applied to the MIDI IN input, the internal LED D2 of the optocoupler does not receive any signal (no key depressed at keyboard) and is simply blocked or OFF. As a consequence of this, since there is no light transmission from D2 to transistor T1 inside the optocoupler, this transistor remains totally blocked. Then the voltage at its collector (pin #5) will stay very near + 5 Vdc.

This + 5 Vdc voltage is also routed to pin #1 of IC-1A and since this IC is an inverting-buffer, the voltage at pin #2 will be 0 Vdc.
This 0 Vdc is applied to pin #3 of IC-1B (and others) which is also an inverting-buffer. Then, the voltage at its pin #4 will become + 5Vdc.

It is recommended during this test to connect one LED with its anode to pin #4 of the MIDI OUT socket and its cathode to pin #5.

Since DC voltage between pin #5 and pin #4 are both very near +5 Vdc, the LED is simply OFF. So, **without** any MIDI input signal, testing LED must remain **OFF**.

MIDI ON condition: if MIDI signal is present at MIDI IN socket, the internal LED D2 of the optocoupler will become conductive, light will energize the transistor T1 which becomes saturated. The voltage at its collector (pin #5) drops near 0 Vdc.

This 0 Vdc is also found at pin #1 of IC-1A. By its inverting function, + 5 Vdc is now available at its pin #2 that drives the pin #3 of IC-1B (and others).
The inverting function of this IC-1B renders its pin #4 near 0 Vdc.
Under this condition, the cathode of the testing LED becomes negative opposite to its anode connected to + 5 Vdc and hence becomes conductive.
So, **with** MIDI input signal, testing diode must be **ON**.

Do not confuse MIDI ON and MIDI IN.
MIDI ON means presence of MIDI signal. MIDI IN refers to the socket itself.
Inversely, MIDI OFF means absence of MIDI signal and MIDI OUT refers to the socket itself.

6. X-66 Installation.

The MIDI distribution box is simply fixed as shown on the next picture. No wiring can be seen from the outside.

7. Conclusion.

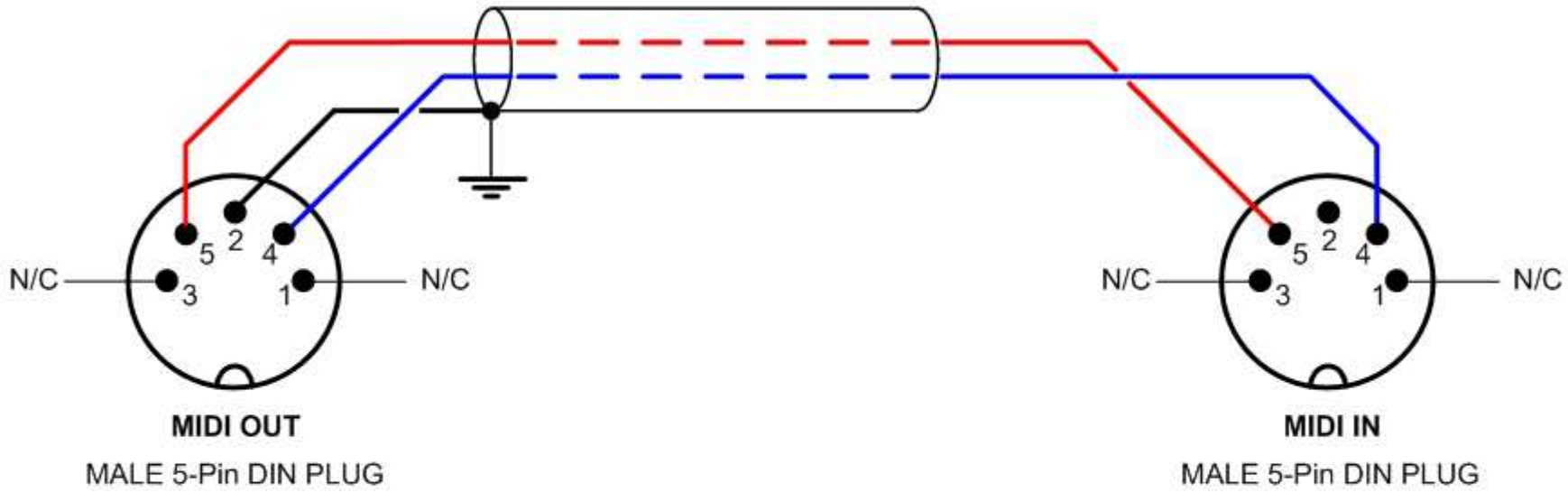
Realization and installation of this MIDI distribution box in Hammond X-66 is quite easy and as already announced, this accessory can also be used with any master keyboard equipped with MIDI OUT socket.

MIDI cables can also be easily wired. Refer to wiring diagram on the next page.

Trust having been of some help,

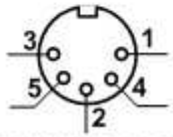
Dan. Vigin

MIDI CABLE

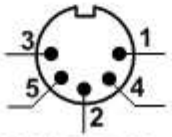


Notes.

1. Connect 'Pin-to-Pin' both DIN plugs
2. Shield to be connected to Pin #2 of MIDI OUT plug only.
3. N/C = No Connectiion



FEMALE 5-Pin
DIN SOCKET



MALE 5-Pin
DIN PLUG

MIDI Cable
File: 4_Chan_MIDI_Output_01.vsd
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