

## MIDI ON X-66

### 'TALK' SCENARIO - PART ONE - INTRO & DEMO's.

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**Insert background music: Whiter shade of pale - Pete Colley**

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Hi, ! The purpose of this Video is to demonstrate the benefit of implementing MIDI on the Hammond X-66 Console.

MIDI system has been only installed on the Upper manual and does'nt affect any other feature of the organ, except the ORCHESTRAL TRAPS that has been deleted.

Beside that, the original sound of the X-66 remains unchanged.

That was the objective.

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Before starting, I feel somewhat sorry for the poor background behind me but my X-66 is still in the workshop. This explains that.

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This Video is split in two sections.

The first part provides a basic description on MIDI seen on the player side with short MIDI demo's.

The second part is mostly ' technically' oriented. This means: theoretical description, "how it works", installation and cabling, recommendations, etc...

Let's start with a short MIDI demo to introduce this.

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**PLAY: Theme of Schindler list (solo violin)**

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While playing, you can switch at any time from MIDI to X-66 or you may also play both together.

That's also known as 'Local ON and OFF' in the MIDI language.  
Let's see that.

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**PLAY: "Watch what happens" - Voices PC2R expander**

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Using the ORCHESTRAL TAB was clear to me because nowadays with computer drummers, this feature is almost never used.

On top of that, the ORCHESTRAL TAB is just located in the center of the console and then easy to turn ON and OFF during play.

As you are certainly aware, the sound you are getting with MIDI only depends on the MIDI equipment connected to the X-66.

The upper manual of the X-66 only supplies MIDI OUT signals in order to drive external MIDI expanders, synthesizers, sequencers and the like. Nothing more.

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**Is the MIDI IN also included ?**

This question is often asked. The answer is NO !

The addition of MIDI IN feature is not implemented since this would entail a complete re-design of the whole organ.

At this moment, the output level of MIDI signals is fixed.

This means that it's up to the organ player to adjust the output level with the swell pedal in such way to provide some expression when playing.

However, if MIDI expanders are installed on top of the X-66, it's quite easy to adjust the output levels when needed.

Another interesting point is the Octave Selector or Octave Transposer if you like. This small button has three positions: Lower, Normal, Upper.

In fact, you can adapt the octave position either according to your convenience during play or to get optimal sound reproduction from the MIDI devices.

Let's see how it works.

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**Play: ' Corcovado ' - 3 times (Normal + Upper+Lower)**

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The MIDI system implemented is based on the CTM principle.

With MIDI, there are several options.

Today's MIDI keyboards are almost all 'Key Sensitive'.

To make it short, the output level depends on the attack applied on the key like a piano for instance.

In my case, only 'Contact-to-Midi' or **CTM** is used.

When playing a key, the contact is ON, when releasing the key , the contact is OFF.

As simple as that.

Initially, it was my intention to install sensitive contacts (rubber switches or dual switches) in upper keyboard of the X-66 but this idea was discarded for two major reasons:

Firstly , on a mechanical standpoint, this would involve a lot of work due to the lack of room under the keyboard entailing reliability problems on a long term basis.

Secondly, the addition of more contacts on top of existing fifteen contacts per key would also modify the touch pressure of the keys and this was against my intention.

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**Funny title " B3 by X-66 " .**

I have discovered that the Kurzweil expander PC2R was equipped with an outstanding tone-wheel synthesis engine in KB3 mode.

To my opinion, it provides one of the closest classic B3 sound with Leslie effect. Let's see that.

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**Play : Hammond B3 'jazzy' sound**

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The connection to external MIDI devices is quite simple and will be fully explained in the next part of this video.

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**Insert background music: Whiter shade of pale - Pete Colley**

**End of PART ONE.**

## 'TALK' SCENARIO - PART TWO - TECHNICAL OVERVIEW.

**Insert background music: Whiter shade of pale - Pete Colley**

Hi !, We have seen in Part One the benefit for the organ player to drive external MIDI components from the upper keyboard.

MIDI will provide an infinity of additional sounds on top of the X-66.

This technical part only provides a general overview and has been summarized on purpose.

Full information is available on the Hammond X-66 Website

Let's start with a look to the overall block-diagram.

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### **SHOW : Block-Diagram - MIDI implementation (4 views)**

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As shown, three major elements are involved inside the console:

- the raw of contacts located under the keys of the upper manual
- the Midi interface unit specially designed to be integrated under the keyboard
- the Contact-to-MIDI converter CTM64 and final cabling

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As you can see on this picture, MIDI OUT signals from the CTM64 are connected directly to the external MIDI equipment.

The analogue outputs of each MIDI unit are feeding an audio mixer which in turn drives a power amplifier connected to the speakers.  
Nothing really new up to that.

Let's start with the ORCHESTRAL TRAPS contacts.

## 1. ORCH TRAPS CONTACTS.

While the upper manual is equipped with 15 rows of contacts per key only the ORCH.TRAPS row provides DC voltages that can be exploited to trigger the interface unit.

Let's see on the next diagram.

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### SHOW: X-66 Traps circuit.

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Don't worry if it looks complex at the first sight.  
Let's put the oscilloscope probe exactly at point B and see what happens.

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### SHOW: Scope at Point 'B'.

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When the key is ON, you hear it, you can see that the voltage at point B decreases from +26 Vdc to 10 Vdc.

The concept is to take the benefit of those existing DC voltage variations to drive the interface unit and this without modifying the other circuits.

Of course, as already announced, using this ORCH.TRAPS as MIDI command will sacrifice the original ORCH.TRAPS function. .

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Now, the next operation is to see how to reach this Point B in the keying module since we need to connect this contact point to trigger the interface circuit.

Theoretically, it looks simple but it is probably the most delicate part of the MIDI installation.

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### SHOW: Keying Module.

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All the bakelite separators located between each keying module have to be removed. Then a short piece of single wire of about 5 cm has to be soldered at the foot of each resistor. Remember Point B in previous shot.

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The other end of this piece of wire has to be winded up on the nearest notch of the keying module. A thin iron solder is needed and be quick during soldering to avoid plastic melting. This operation has to be done 61 times.

Now, we have access to all Points "B" and flat cables can be connected to the interface module. Just have a look on top of the interface board.

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**SHOW: Interface connecting.**

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**2. INTERFACE UNIT.**

This addition of a MIDI interface unit is unavoidable for two basic reasons:

- Since it is the intention to preserve the original performances of the organ then the input circuit of this interface involves high-impedance input.
- The MIDI converter CTM64 only supports ON/OFF switching signals to be converted into MIDI data signals.

The +26Vdc or +10Vdc available at Point B are not usable as such and have to be adapted accordingly.

Based on that, it's easy to conclude that the interface unit will be composed of the input circuit (high impedance) which role is to convert the voltage variations at Point B into +12 Vdc when key is ON and 0Vdc when key is OFF.

Those two DC voltages will drive directly the control pins of a bilateral IC CD4066 in order to provide ON/OFF contact to the MIDI converter CTM64.

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**SHOW: MIDI interface INPUT diagram.**

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Let's see the Interface input diagram.

How it works. In short, if the key is OFF, the same voltage will be applied to the base (b) and emitter (e) of the transistor Q1 which remains blocked.

The voltage at Point C will be 0Vdc.

If the key is ON, about +25 Vdc is applied on the base of the transistor Q1 which becomes conductive and the DC voltage recuperated at Point C, this time, will be near +12Vdc.

Let's confirm this on the oscilloscope.

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**SHOW: Oscilloscope pattern at Point C.**

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As we have seen on the oscilloscope, since we have now the correct signals, we can connect all those Point C directly to the Switch Control pins of the CD4066 IC.

This IC operates like a normal switch.

When +12Vdc is applied to the SW pin the corresponding contact is ON.

When 0Vdc is applied, the contact is OFF.

That's exactly the function required to drive the CTM64 MIDI converter.

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In practice, the Interface unit is composed of three Printed Circuit Boards.

Two for the interface itself and one for the Power supply.

Those three PCB's are installed on a metal plate as near as possible to the keying modules in order to minimize the length of the flat cables.

The metal plate is mounted with clamps for easy rotation around the metal rod.

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**SHOW: Views of interface unit and wiring.**

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The power supply unit (PSU for short) is quite basic and uses only one 7812 regulator to feed the +12 Vdc for the CD4066 IC's.

This small PCB is located at the right end side and is fed by the +28Vdc available from the X-66 Power Supply Unit.

The four output flat cables of the interface unit located at the bottom of this picture are supplied in the CTM64 kit and terminated by 16 pole female connectors.

The complete set of documentation ,including PCB layouts, with much more technical details is available on the X-66 website.

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### **3. MIDI Converter CTM64.**

This last part is the certainly the easiest one.

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#### **SHOW: Views of CTM64 installation inside X-66.**

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"Doepfer Musikelektronik" delivers the complete kit ready to operate however the metal enclosure is not included.

The CTM64 PCB is installed on a metal plate with shield and fixed with two screws on the top of the scanners block in order to get flat cables as short as possible.

The flat cables from the interface unit terminated with connectors are inserted in the corresponding position.

Installation and settings are clearly explained in the CTM64 user's guide.

One 5-pin DIN plug and cable is connected to the MIDI OUT socket of the CTM64 and assure a point-to-point link to the MIDI 5-pole socket with locker located under the console in order to connect the external MIDI devices.

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The +12 Vdc from the X-66 Power Supply Unit has been connected directly to the power socket of the CTM64.

This way of doing will avoid ground loops.

It is not recommended to take the +12Vdc available from the Interface unit as we have seen beforehand.

## **Final cabling of MIDI converter CTM64.**

The last action is to finalize cabling. Nothing really complicated.

Let's have a look to the Overall connecting diagram first.

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### **SHOW: Overall connecting diagram.**

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The ORCHESTRAL TAB and the Octave Selector still need to be wired.

Former ORCH.TAB cabling has to be modified as shown in red colour in this picture.

One ON/OFF contact is required at MIDI ON tab .

To activate MIDI function the common lead to JP6 point on CTM64 is simply either closed or opened.

That's what MIDI ON tab is doing.

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### **SHOW: Drawing with initial ORCH.TRAPS wiring.**

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This picture shows how the new wiring behind the MIDI TAB should look like. On this view, the original cabling. On the next one, the modifications.

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### **SHOW : ORCH.TRAPS drawing and wiring modifications.**

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The last action concerns the Octave Selector.

While being optional, it seems interesting to my opinion and easy to implement.

Only three wires have to be installed between the selector switch and the CTM64. Shielded wires are recommended.

Connecting diagram is supplied with the CTM64 user's guide.

Beside the square hole punching to accomodate this selector nearby the Szorzando piston, the rest is rather easy to realize.

## **PART TWO - Final**

Well, this technical part on MIDI installation is now completed.

It's obvious, as you can imagine, that all information have been intentionnally condensed .

Anyhow, I trust having been of some help for those who intend to install this MIDI system on their X-66.

Thank you again for your attention.

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**Final background music: Whiter shade of pale - Pete Colley**

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**END OF PART TWO.**

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