Instructions for assembling the GINO-MIDI INTERFACE

BIGMIDI version 1.0

Disclaimer

Before you start building any of the projects on this website, keep in mind that I can't be held responsible for any damage that is caused by building and using the designs related to the GINO-MIDI Interface. All effort has been done to make the schematics and instructions as correct as possible and the whole project is successfully tested and used by not only me, but also by others then me.

Partlist Masterprint BIGMIDI-1

Semiconductors

IC1	74HCT138 (8 to 1 address decoder IC)
IC2	ATMEGA8535 (Pre-programmed GINO-Core IC)
IC3	7805T (voltage regulator) 1A (Vin=max 9V)
IC4	74HCT04 - Hex Inverter

Resistors

R1	470 ohm ¼ watt
R2	150 ohm ¼ watt
R3	NA
R4	NA
R5	220 ohm ¼ watt
R6	220 ohm ¼ watt
RN1	Resistor network, 8 x 22K , common out (¼ watt)

Capacitors

C1	100nF (ceramic or disc)
C2	100nF (ceramic or disc)
C3	100nF (ceramic or disc)
C4	100nF (ceramic or disc)
C5	100uF/25v (Electrolytic or tantalum)
C6	100nF (ceramic or disc)
C7	22uF/16v (Electrolytic or tantalum)
C8	33pF (ceramic or disc)
C9	33pF (ceramic or disc)

Crystal

Q1	X-tal 4 Mhz

Diode's

D1	1N4001 of 1N4002 (Voltage rectifier diode)
LED1	Standard green led

Several parts

1	IC socket (40 pin) for the ATMEGA8535 processor
1	IC socket 16 pin for the 74HCT138
1	IC socket 14 pin for the 74HCT04
1	20 Pin Shrouded Male Headers
1	14 Pin Shrouded Male Headers
6	3 Pin .100" Polarized Header Connector
6	3 Pin .100" Straight Male Polarized Headers
2	Krimp Pin voor Header Connector 10 pieces
1	entree for supply
1	DIN 5 Pin Right Angle PCB Mount Socket
1	Cooler
4	Spacers
4	Parkers
1	Isolated mounting wire for interconnections
1	PCB GINO 31012011-1

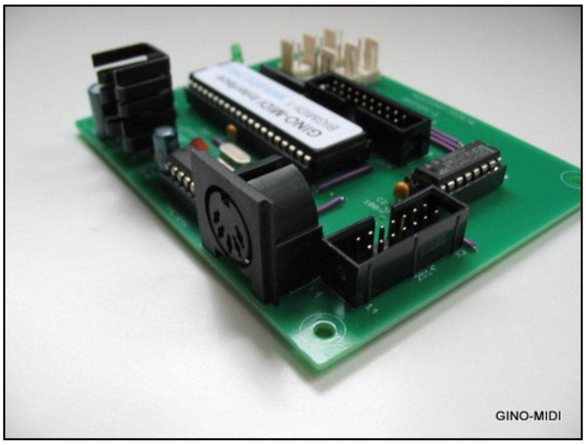
Introduction
The BIGMIDI-1 is the bigger brother of the (first) GINO-MIDI interface, now called the Small-Mid 2, and is designed for the console of an organ to be equipped with a midi output. Via a midi output it is possible to control and play an expander or a personal computer. Especially the last application now offers many possibilities to play a truly digital organ on the personal computer.
On the Internet you can download applications with which you can build a virtual organ on the personal computer. Examples include jOrgan of Sven Meier and Grand Orgue. Both freeware software. Furthermore is called Hauptwerk. This software is not free, but does have a demoversion.
The configuration of the BIGMIDI-1 consists of up to eight ports on each 64 switches to distribute as desired on 5 keyboards(61 notes), a pedal(32 notes) and two stop panels of 64 registers each.
It is also possible for six keyboards to use a volume control and one can change various parameters and store them in the permanent memory of the microcontroller. Through three function buttons and an LCD screen you can change these parameters.
There is also a LED that shows each "MIDI event".

The circuit
The heart of the BIGMIDI-1 consists of the circuit around the microcontroller ATMEGA8535. The microcontroller reads keystrokes, hence goes to work and translates it to midi codes. The diagram around this microcontroller can be found on the page Downloads in the file titled Masterprint in .pdf format. This diagram shows the power around the circuit of the microcontroller and the midi output.

The keyboards and the register panel are connected through a ribbon cable to this circuit, through the IDC connector X1. This flat cable I call in this guide the GINO BUS. Q1 and two capacitors C8 and C9 provide a continuous clock signal of 4 MHz.

The TXD output of the microcontroller PD1 is the midi signal and inverted by IC4.
IC1 is an address decoder that determines which of the eight ports (keyboard and read registry panels) will be read.

The power supply consists of an 78T05. This is a 5 volt voltage regulator that can deliver up to 1000 mA. To connect the supply voltage it must not exceed 12 volts DC. Preferably a bit lower, 9- volt also complies excellent. Many adapters provide a much higher voltage so that with a load the voltage finally is issued. The BIGMIDI-1 uses very little power, not more than 90 mA. The adapter is in most cases not be fully loaded, so the voltage remains high. This may give some heat in the 78T05. So consciously choose an adapter that goes unloaded measured no higher than 12 volts DC. Note the polarity!



The program of the ATMEGA8535 read in a very fast pace the state of the switches of the keyboards and the registerpanels. This data is stored in the memory of the microcontroller and converted into MIDI data.

In the original design I use for the keyboards and register a diode matrix. This diode matrix makes a division of key contacts in groups of 8 keys. So for a five octave keyboard matrix you have 8 sections of 8 keys needed. In total, we can read 64 keys. Sufficient, for a five-octave keyboard has a size of 61 keys. Before a diode array can be read, we must first have a decoder circuit between the diode matrix and ATMEGA8535. This decoder is controlled by the ATMEGA8535 and IC1 and provides eight pulses per cycle. For each pulse the AT reads a portion of the diode matrix.

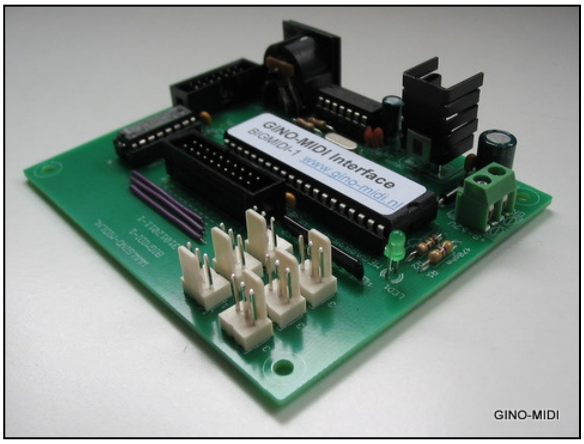
To reduce the wiring from the main board to the keyboards and register panels the decoder PCBs are placed at the keyboards and their matrix. The main board and the decoder PCB's are connected by the GINO-BUS.

Assembly.
The print is designed so that we can suffice with a single sided PCB. This will mean that first we have to make some interconnections. In total there are 8 interconnections. Make sure that these

connections are stripped by size and that they lie flat against the PCB surface. We then assembly the resistors, the 1N4002 diode and IC sockets.
Observe the IC sockets on the mark of pin1, and the diode on the cathode sign. There is also a resistor network, which is RN1. Again, be careful, what is the common pin.
Then we mount capacitors and electrolytic capacitors (capacitors). Observe the electrolytic capacitors polarity. The crystal and LED are the last of the components. The LED also has a polarity.
Then the voltage regulator is mounted. This is first provided with the snap-cooling body. You can slide the 78T05 into the heat sink, so you get an element with four pins. This corresponds with the PCB. The cooling body is provided with a solderable lip.

The connectors.
The design of the BIGMIDI-1 is based on the idea that this board somewhere in the console is installed, and the connections of the power and volume controls on the outside of the organ cabinet. Therefore it makes no sense to assemble an entry for the power supply or potentiometers on the board.

<u>Polarized headers J1, J2, J3, J4, J5, J6</u>
Therefore, the potentiometers (J1 ... 6) uses the so-called polarized headers. It needs some patience and precision. The male headers of this polarized headers you can apply directly to the PCB. See also the installation diagram for the correct direction. Attention, the drill size of the print is a little bit wide for this headers, so keep them in place if you soldered them. First determine the length between the location of the main board and where the potentiometers are placed in the organ cabinet.
The female part of these connectors consist of an empty plastic body according to the number of openings, a number of crimp pins. It is intended that we mount flexible wire to the crimp pins. Use flexible wire with an outer diameter of 1.2 mm dia. Normally, this wire assembly consists of 18 cores of 0.1mm.



Strip the wire for 3 mm and turn the core together. Place the tip of the stripped wire into the crimp pin so that the insulation of the wire is at the height of the large lips, and the stripped part of the wire is at the height of the small lips. First bend one of the big lips and then the second big lip, so the insulated part of the wire is clamped into the crimp pin. Then you bend the small lips and clamp the stripped part into the crimp pin.
The pins being clamped to the wire are now slided in the empty shell of the female connector so that the locking of the crimp pin from settling into the hole on the front of the sleeve of the female connector. Use a thin tweezers to crimp the pin far enough into the sleeve.

Be careful when taking apart these polarized headers always take the sleeve of the female part, and do not pull on the wires when disconnecting.

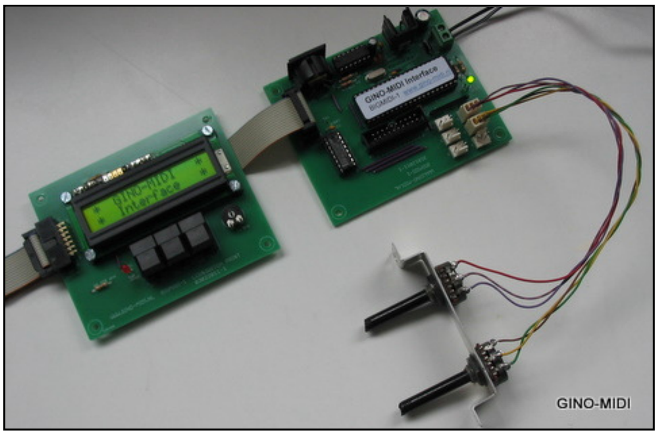
<u>Connecting the potentiometers</u>
The potentiometers that we are using to adjust the volume of the 6 channels should have a value of 100Kohm linear, and they are connected to the polarized headers J1 to J6. It will not often arise that all six channels are provided with a potentiometer. In the case you will not connect a potentiometer the volume of that channel will be on the maximum. You don’t have to make an interconnection.
Note: the runner of the potentiometer is connected to pin 1 of the polarized header, de highest volume level on pin 2 (+5v) and the lowest volume level on pin 3 (=GND).
The volume is controlled from 0 to 127 or in hexadecimal from 00H to 7FH with an interval of two steps. This interval is created because when a volume level is chosen for instance between 09H and 0AH the system will send out undesirable midi messages.
(Connector J7 is not in use. This is a connection that is of use when in the future the software might be adjusted. The possibility exists that the microcontroller can be provided with new software through this connector and a dongle at the printer port of your computer. We call this In System Programming)

When you solder the headers J1 to J6 be aware that will stay on the right place. The holes in the PCB are a little bit wide, so it is imaginable that this connector fall out of the PCB when you are soldering.

<u>Power supply X2</u>
For power supply we use a printing terminal block. Give a mark to which the + and – of this connection.

<u>IDC connectors X1, X3</u>
To connect the GINO BUS and connecting the LCD & Switch board, we use IDC connectors. On the main PCB male headers are now installed. Note the numbering of pin 1 indicated on the assembly scheme. This is indicated by a small triangle on the male header. For the GINO BUS we use the 20 pin header for the LCD & Switch board, we use the 14 pin header. The advantage of the IDC connectors is that they are robust and that the female part is always inserted in the right way in the male header.

The print design is also suitable for GINO BUS old style that was made of DIL ribbon cable connectors. Here you can read about later in this manual.



Portnumbers.
About midi codes and all details in that field you can find a lot of data on the Internet. Here we will not go into details in this description. However we will discuss in this article the use of port numbers.

The BIGMIDI-1 has eight port numbers that we can select with the jumpers. These are the ports numbered 1, 2, 3, 4, 5, 6, 7 and 8
Port 1 is used for e.g. the first set of 64 stops
Port 2 is used for e.g. the main manual
Port 3 is used for e.g. the second manual
Port 4 is used for e.g. the pedal
Port 5 is used for e.g. the second set of 64 stops
Port 6 is used for e.g. the third manual
Port 7 is used for e.g. the fourth manual
Port 8 is used for e.g. the fifth manual

The ports 2, 3, 4 and 6, 7, 8 can be freely mixed, but the ports 1 and 5 and are reserved for the registry switches, the stops. Thus, one can through the little interconnections or jumpers on each matrix decoder select the desired port number. Through the software, we can for each port choose the desired MIDI channel number.

Diode array
In the proposed diagram you can see that we use a diode matrix to read the keys and stop switches. A diode matrix is controlled by a decoder circuit. This decoder circuit receives signals from the mainboard to activate the right matrix part.
The disadvantage of a diode matrix is, that we have to divide the key contacts in groups of 8 keys. The key-contact rail can not be in one piece, but should be divided into 8 short pieces of 8 keys.
The advantage is that we only need one diode per key and these diodes (1n4148 =) are relatively inexpensive.
An alternative is to use octal buffer / line driver, such as the 74HCT541. Thereby is per group of eight keys the need of a resistor network and for each key again a diode. This method is especially

important if the current electronics of the organ is to maintain. Thereby, one should pay attention to the keycontacts for the voltage used. Also with this method of reading a decoder circuit is needed.

Use of current.
The circuit uses a current of 90 mA including LCD & Switch board. Most of the current is consumed by the backlight of the LCD screen.
If the 74HCT138 decoder circuits with array of keyboards and / or pedal and stop switches is connected, the current will not increase. This type of HCT uses almost no current.

Testing the circuit.
It is possible to test the circuit without the use of a keyboard.
First of all we will check if the supply voltage is correct. Do not place any integrated circuit in the sockets.
Check the plus and minus connection of the power supply and connect the main print with a DC adapter. For the power supply you can use a DC adapter which gives a voltage from 8 till 12 volt DC. Notice that the voltage of 12 volt should not be exceeded.
If there is no load on the adapter the output voltage will be soon 15 volt and because this circuit draws almost no current, no supply voltage will be reduced by the load.

Note: Use to disable this circuit always a neat on/off switch. Stop not just the adapter without the intervention of switch in the outlet.

Measure the supply voltage for example on pin 16 of the IC socket of IC1. There must be a 5 volts DC on it. If this is not the case, then inspect the circuit again thoroughly. Is IC3, the voltage regulator, connected properly? There are some of those easy mistakes.
If the supply voltage is correct you can put the IC1, IC2 and IC4 I the sockets. Notice the direction of the ICs.
Then connect the MIDI Out to the PC or with a midi instrument. Switch the power on. There will apparently nothing happen, because we did not connect any decoder and diode matrix to the GINO Bus. Nevertheless, the circuit sends already a midi signal. Namely, the codes All Notes Off. More on that later.
We are now going to simulate a keyboard. Make a short cut between for instance pin X1-6 and pin X1-17 of the GINO-Bus (IDC connector).

You will hear now a reaction of you midi equipment. We simulate now that we are pressing the first key of every matrix. This sound is composed of many tones and we can not hear which ones, but it is a way to see that the heart of the midi interface is working. If you have a **midi monitor** available on your computer, then you can follow these actions on the screen of your PC or laptop.

Is there no reaction, or output at all, then you have to examine the circuits once again. You can also monitor if the first midi signal (All-Notes-Off) is transmitted by the midi interface. For each of the 16 channels the code All-Notes-Off is transmitted and you can follow this on a midi monitor. Underneath you find a link where you can find a very good midi monitor. A must have for each midi freak.

www.midi-ox.com

GINO-Bus
The GINO-Bus connects all the decoder circuits with the main board. Underneath you find a specification of this bus. At the first GINO-MIDI interface DIL flatcable connectors were used. These connectors appear fragile when you had to connect en disconnect these connectors. Especially for the DIY builder it is of interest that these connections are robust. At the same time these connectors were not so easily available and they were expensive. Therefore the design of the BIGMIDI is adjusted in a way we can use the IDC connectors, but the PCB is still suitable for the use of the DIL flatcable connectors.

Pinnr IDC connector	Pinnr. DIL Flatcable connector	Name	Description
X1-20	1	POORT 1	Signal 1th panel for stopswitches
X1-18	2	POORT 2	Signaal keyboard/pedal
X1-16	3	POORT 3	Signaal keyboard/pedal
X1-14	4	POORT 4	Signaal keyboard/pedal
X1-12	5	POORT 5	Signaal 2nd panel for stopswitches
X1-10	6	POORT 6	Signaal keyboard/pedal
X1-8	7	POORT 7	Signaal keyboard/pedal
X1-6	8	A2	Adres 2 for decoders
X1-4	9	A1	Adres 1 for decoders
X1-2	10	A0	Adres 0 for decoders
X1-1	11	GND	Massa
X1-3	12	D7	Data 7
X1-5	13	D6	Data 6
X1-7	14	D5	Data 5
X1-9	15	D4	Data 4
X1-11	16	D3	Data 3
X1-13	17	D2	Data 2
X1-15	18	D1	Data 1
X1-17	19	D0	Data 0
X1-19	20	+ 5 VOLT	Supply 5 volt

Port 8
The observant reader will see that the connection of 8th array (port 8) in the GINO Bus not is included. That’s right: to keep the compatibility with the old GINO Bus this (mostly unnecessary) connection is not included in the GINO Bus. In the case of using this port, a loose connection must laid between TP1 and TP9 of that particular decoder print.

Finally
I have tried in this guide to mention many items according to building this GINO-MIDI interface.
If you have remarks and comments, please let me know. Also my English is a little bit poor, so feel free to correct me. This allows other users to take advantage of them. Good luck with the construction of the BIGMIDI Interface

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