

ORGAN HARDWARE BOARDS For REAL or VIRTUAL PIPE ORGANS

USER'S MANUAL

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**Pascal Leray
Dr-Engineer**

R&D for ORGANBUILDERS

pascalleray.ftd@free.fr
<http://pascal.leray.free.fr>

SUMMARY :

Building at very low cost a small or huge pipe organ, or a simple Virtual Pipe Organ (VPO) is now available : Our set of organ hardware electronic boards allows now any organbuilder or organist to design and build any small or large pipe organs, or VPO. Even old trackers, new or refurbished register pipe organs, classic or recent can use our hardware set.

Only 4 items are necessary :

- Input board : Which can receive up to 8 keyboards/pedal
- Opto isolated Interface board, which can drive power output boards
- Output boards, available in 2 versions : 64 outputs with Darlingtons or 4x64 outputs with integrated Darlingtons. (in case of real Pipe Organ control; Not necessary of course for VPOs)
- A standard PC with parallel interface. (even recent, low cost PC's are available with Parallel interface.

All these boards can be controlled remotely. Using telecommunication lines for very long distances (concerts were done with 100 km distance between keyboards and the pipe organ), or 100m using USB interface

All these boards can be controlled by **MIDI interface from the PC**, without additional hardware.

They have all a separate 5V input regulator. A separate 7,5V power supply is sufficient.

INPUT BOARDS :

PART 1 : MIDI/USB interfaces :

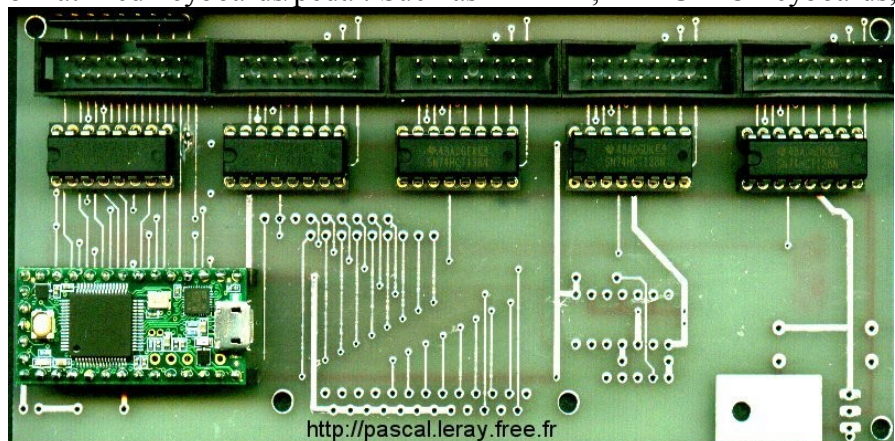
1. KI_5_FATAR_USB:

This board can drive any 8x8 matrixed keyboards/pedal. Such as FATAR, M-AUDIO keyboards, and so on. With only 1 micro USB output.

2 modes :

5x1x8x8 matrices; or
2x2x8x8 matrices, and
pedal.

MODE 1 : with 5 8x8
matrix. Can drive
keyboards with merging
their 2 high low part
connectors.



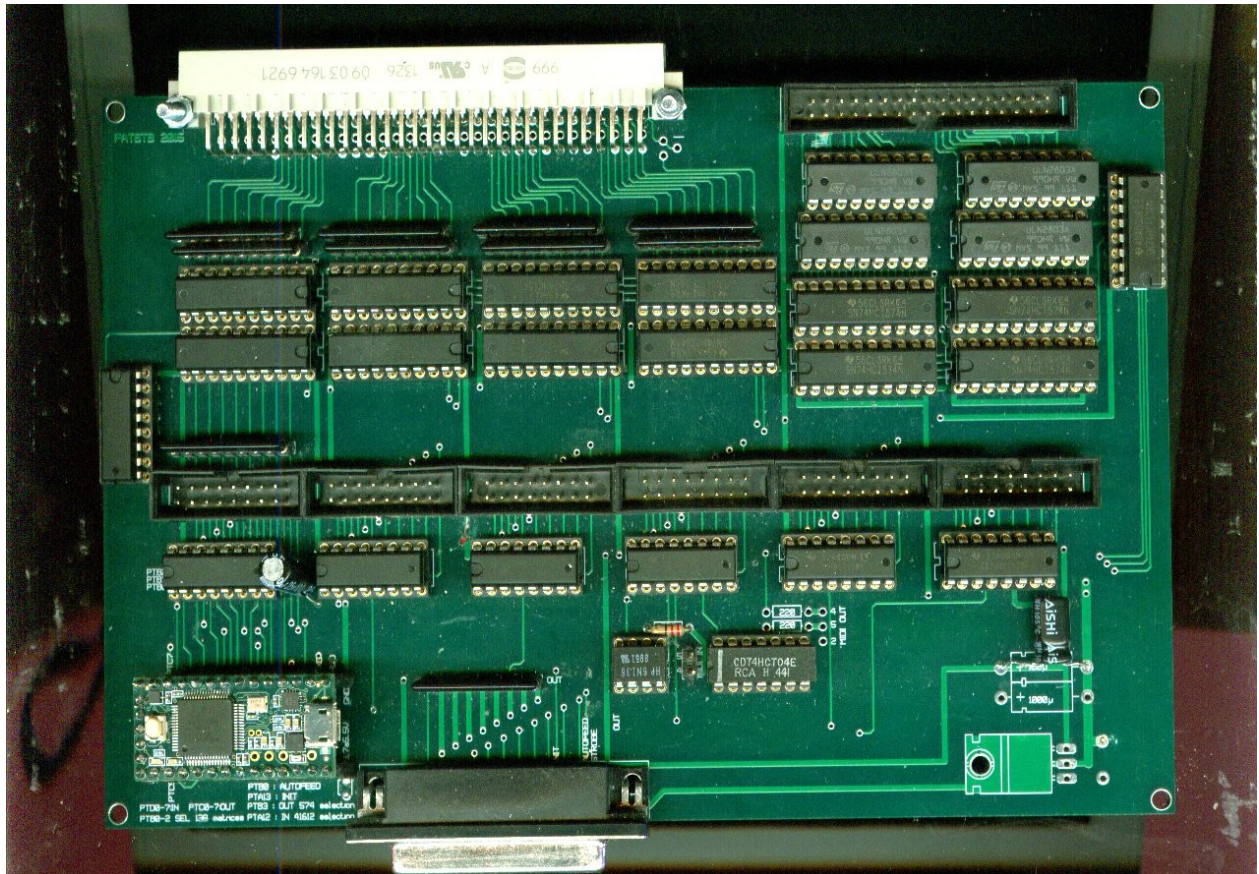
MODE 2 : receives directly the 2 red connectors from each keyboard.

The board can drive also an analog expression pedal.

Easily reconfigurable. No additional power supply : Supply only by the USB port.

Very fast response time, with a powerfull 90MHz ARM microprocessor.

Can be delivered for 6 8x8 matrices connectors.



Full version of the KI6x8x8 Matrixed keyboards.

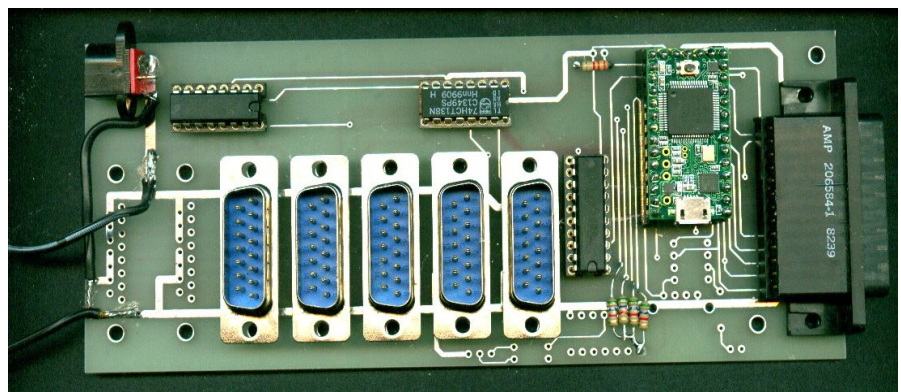
- Up to 6 matrixed keyboards/pedal
- 100MHz microprocessor
- Optional Parallel output for further Pipe Organ controller
- 64 digital input keys
- 32 digital output keys
- Remote control thanks to MIDI IN and OUT up to 18 m.
- Analog expression pedal input
- Direct USB/MIDI output
- No MIDI merger needed

2. KI_7_MIDI_USB :

Can be used with classic organ keyboards without contacts nor matrix connectors. Can drive up to 7 LI_64 inputs, or the direct 2xK32 boards, which can be directly plugged at the rear of any organ keyboard.

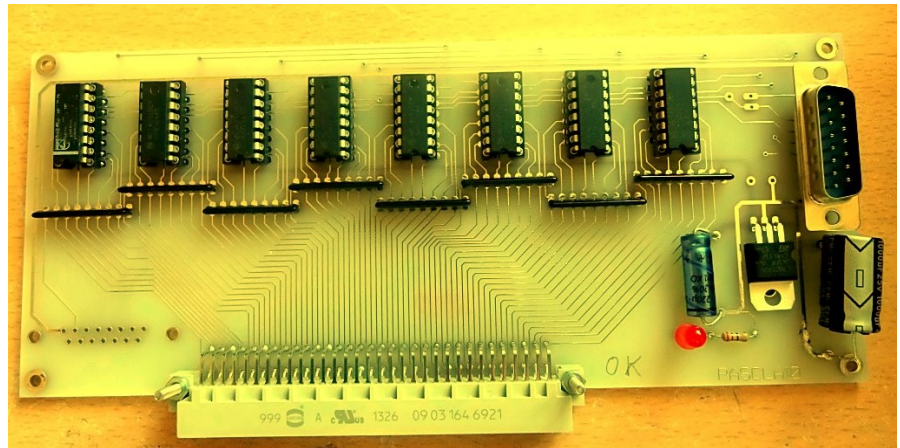
This board has a direct USB/MIDI output, easily reconfigurable. Which can be plugged to any PC if necessary. (usefull for display).

Can drive an analog expression pedal. Each connector can be connected to a KI_64 input. (see under).



3. *KI_64* :

This board can drive up to 64 inputs : Manual or pedal keyboards. With direct contacts, ILS, opto electronic or HALL effect (magnetic)sensors. 12V standard input. Connects any *KI_7_MIDI_USB* boards.

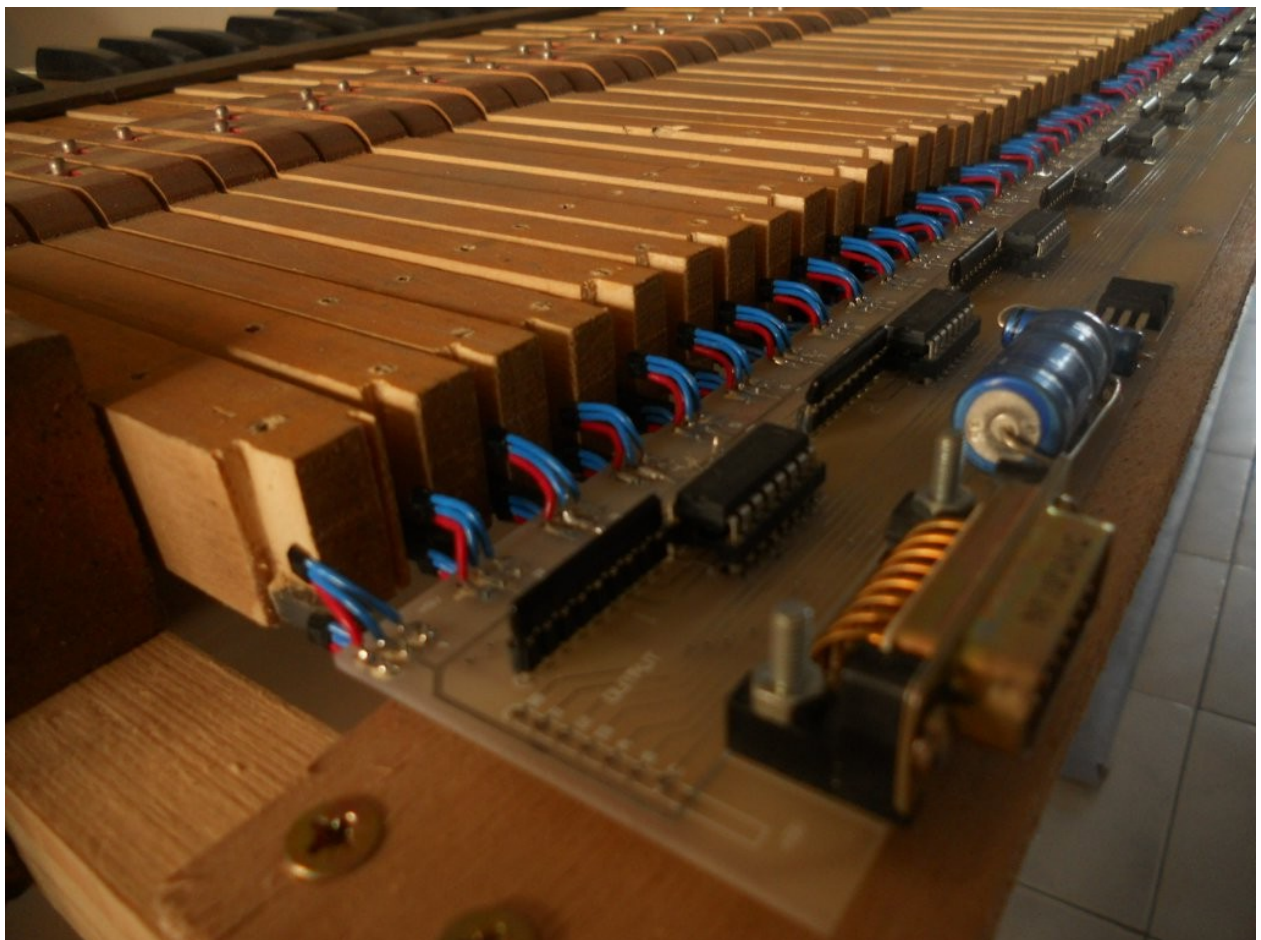


More info here :

http://pascal.leray.free.fr/web_org/ki64_en.html

4. *KIH32*

These boards are able to control any classic keyboard, with contacts, magnetic Reed contacts, optoelectronic or HALL (Magnetic sensors). Each board receives 32 contacts, or HALL inputs.



A complete keyboard needs 2 boards. Available with “on” contact or “on and off” sensor.
Directly compatible with the KI_7_MIDI_USB. Via a DB15 connector, as seen above.

PART 2 : DIRECT PARALLEL INTERFACE BOARDS

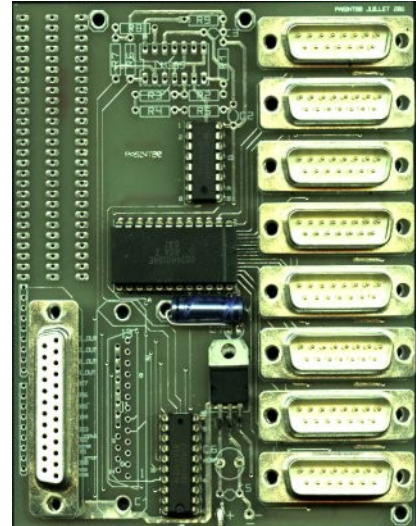
Using the standard Parallel port interface from PC's. (In the case where you have a PC with a parallel port). But the CIPAR board can replace the PC. PC is usefull when high computing power is needed, and a friendly user interface.

This board is the **PC version of the KI7_MIDI_USB**.

VERSION 1 :

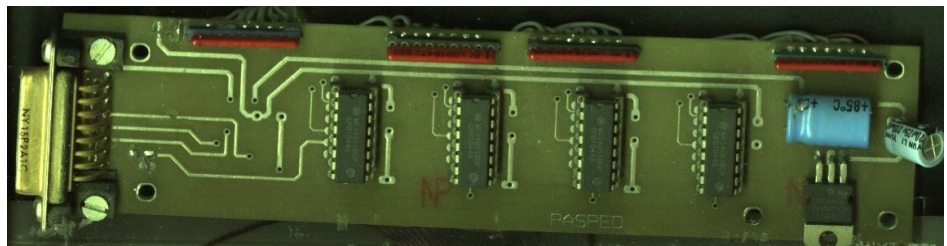
- 8 keyboards in input.
- Output on parallel port

This PC parallel interface can receive either colassic contacts or HALL effect sensor boards KIH32



Drawknobs inputs :

A KI64 input board can be directly connected to the following interface boards. Opto-isolated thanks to the parallel interface board.



Active "on" level is detected by a low level (ground) 0V in input. All inputs are clamped to VCC : +5V.

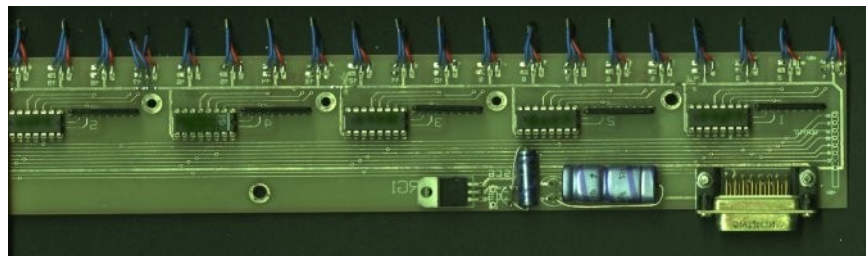
KEYBOARDS INTERFACE : KIH32

Input boards can be connected to KH32 electronic bars, which are composed of 2 sets of 32 inputs. These bars can be plugged directly at the rear of any real pipe organ keyboard.

Other connections are also possible using the version 4 interface, with classic contacts or opto-electronic sensors. Our

keyboard interface board can receive one or two sensors, for detecting the "on" or "off" key position.

Velocity can be sent with the input board in MIDI version.



NOTA :

KI64 nd KIH32 boards can be plugged to the KI7_MIDI_USB with or without PC.

MORE INFO HERE :

http://pascal.leray.free.fr/web_org/ki7_midi_usb_doc_en.pdf

PART 3: PIPE ORGAN CONTROL :

Once we have described our INPUT solutions, let us describe our OUTPUT controller boards, which can drive any (huge or small) Real Pipe Organ :

3 kinds of boards are available, connected to the CIPAR :

- CIPAR Parallel Interface between a PC Parallel Port, or the microprocessor used in INPUT boards.
- O1X64 : able to control directly 64 magnet valves
- O2X64 : able to control directly 128 magnet valves
- O4X64 : able to control 256 magnet valves with integrated Darlington's or placed directly on the magnets.

PARALLEL INTERFACE BOARD : CIPAR

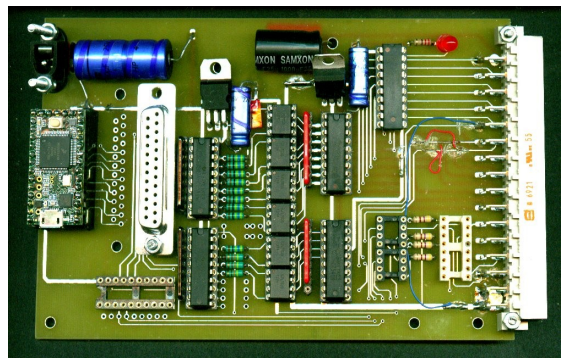
This CIPAR board receives output information from the organ controller running on the PC, via a standard parallel port. ¹

It isolates the PC from the power output boards, thanks to an opto-electronic interface.

Outputs a demultiplexed parallel bus, allowing parallel 8 bit access to magnet valves.

A standard DB25 parallel connector can link any PC to these board. At present, a direct USB port is also available.

This parallel board can drive any real pipe organ, with resistor or inductive loads such as magnets or heavy duty magnets.



More info here :

http://pascal.leray.free.fr/web_org/CIPAR_en.html

SYSTEM WITHOUT PC :

The CIPAR card can be driven by a fast, 32 bits, 100MHz microprocessor, which can replace the PC. For those who prefer avoiding PC's. In this case, one must use drawknobs. Light screens can also be added for registration, and other controls.

All features can be included in the microprogram : Transposer, registration memory, drawknob management, and so on.

The Microprocessor can receive MIDI inputs from any MIDI keyboards.

When classic contact keyboards are used, one can plug a KI7_MIDI_USB card, which can receive up to 7 keyboards or pedals through the KI64 cards.

One can also use HALL (magnetic) effect sensors with 2 KIH32 cards for each keyboard.

Advantage : The system starts instantly, without any latency for booting.

PC is usefull when one are planning to exploit all computing power of the PC's :
Indeed, for very cost effective prices, any PC can offer many advantages :

- Very easy inteface to any kind of displays, touchscreens, virtual (and in fact unexpensive) Drawknobbs.
- Easy interface with any kind of keyboards :

¹ Don't think that parallel port is no longer available on PC's : Even brand new, cheap and small but powerfull MINI-ITX PC's are on the shelves. And classic desktops can also receive parallel port interface on their PCI bus.

- Classic organ keyboards using my LI7_MIDI_USB card and KI64
- New FATAR or Matrixed keyboards, with my dedicated KI6x8x8 card.
- HALL effect sensors for keyboards and Pedals. See several realisations here :
http://pascal.leray.free.fr/web_org/realisations/midification_exemples_en.html
- Only disadvantage : One must wait some seconds for booting. But at present, modern PC's can boot in less than 20s. Time to prepare your organ, registrations, and so on !

The parallel connector :

Is compliant with the well known Parallel port standard.

- Can be used to connect KI7_MIDI_USB or KI6x8x8MIDI_USB cards (*which are also parallel port compliant*).
- Or any standard PC with a parallel interface.
- NOTA : all my boards have a USB/MIDI interface which can be driven by the PC.



OUTPUT POWER BOARDS :

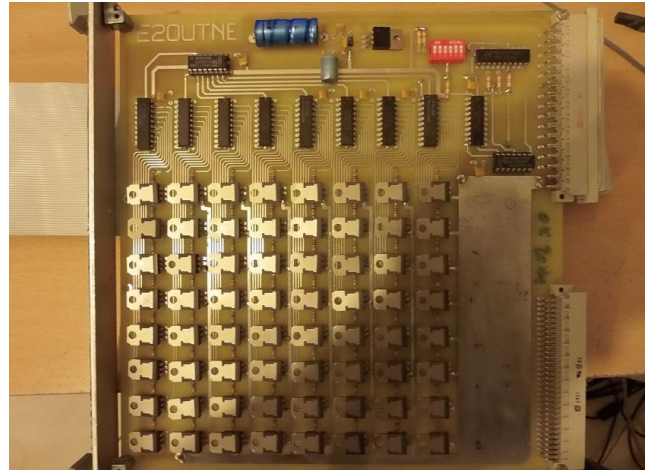
Our 64 or 4x64 boards can be plugged to any PC, using the CIPAR card via the standard PC parallel port. Addresses are defined on the “options.wri” file. Power supply 5V, via a regulator.

The CIPAR *can also be driven by his own Microprocessor*, or by the same Microprocessor on the KI7_MIDI_USB or KI6x8x8 cards.

VERSION 1 : O1X64 :

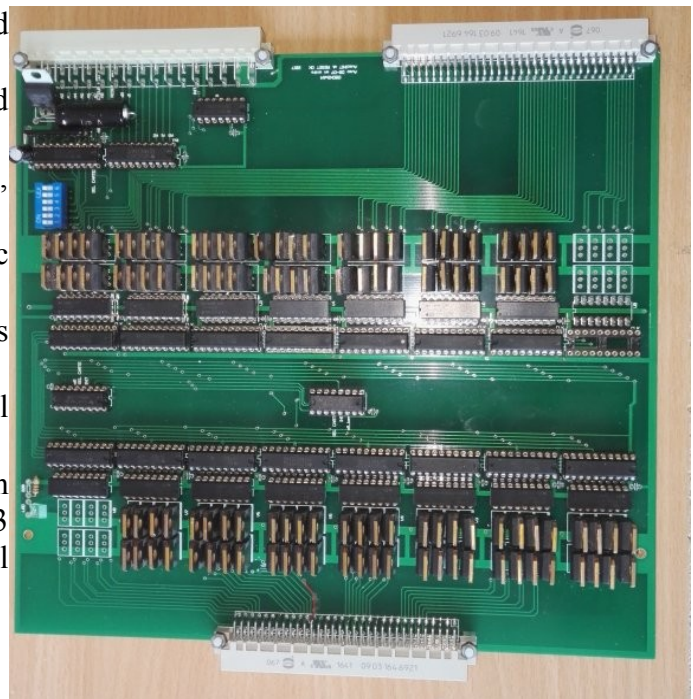
- 64 power Outputs. Each of these outputs can drive up to 7 Amps. Discrete Darlingtons are soldered on the boards. For heavy duty outputs, drawstops, and so on.
- Can drive several registers in parallel, or drawstops, or toeboards.

NOTA : now O1x64 is replaced by O2x64 which is fully compatible.



VERSION 2 : O2x64 :

- 2x64 power outputs on one card only.
- Fully compatible with the 1x64 and the 4x64 cards.
- Up to 32 cards on the same rack, allowing 64x64 power Outputs.
- Fully isolated from the électronique parts of the system.
- Can drive up to 8A per outputs simultaneously.
- Connected to the CIPAR (Parallel Interface Card).
- With only 2 2x64 cards one can control a great organ with 3 windchest divisions plus pedal windchest for example.



More info here :

http://pascal.leray.free.fr/web_org/O2x64_en.html

VERSION 3 : O4x64

- 4x64 power outputs with 4 x 64 pins connectors
- CI integrated Darlington arrays can be put on the board, or soldered directly on the magnets.

These boards can be placed on a standard 19" Rack, with the opto-isolated interface board, connected to the PC. 15 boards can be easily placed on a rack, (theoretically upto 8 boards) allowing direct control of 60 independent unit registers. Of course, several racks can be driven in parallel for unlimited stop number. But one must keep in mind that only 2 2x64 boards can drive any great organ with 3 windchest plus a pedal chest for example !).

Of course, this board can also drive register windchest division, or several registers in parallel.

More info here :

http://pascal.leray.free.fr/web_org/O4x64_en.html

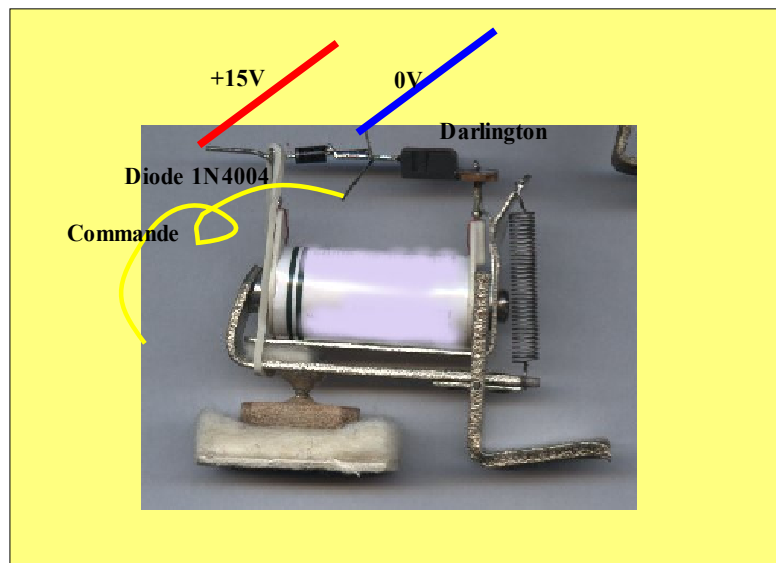


O4x64 Boards are very flexible : One can use them wwith :

- Only a 1K resistor array after the 74HCT574 memories.
- Replace the 1K by a 2803 Darlington array for middle size magnets < 200mA
- Control multiple Darlington. See below.

MAGNETS WIRING :

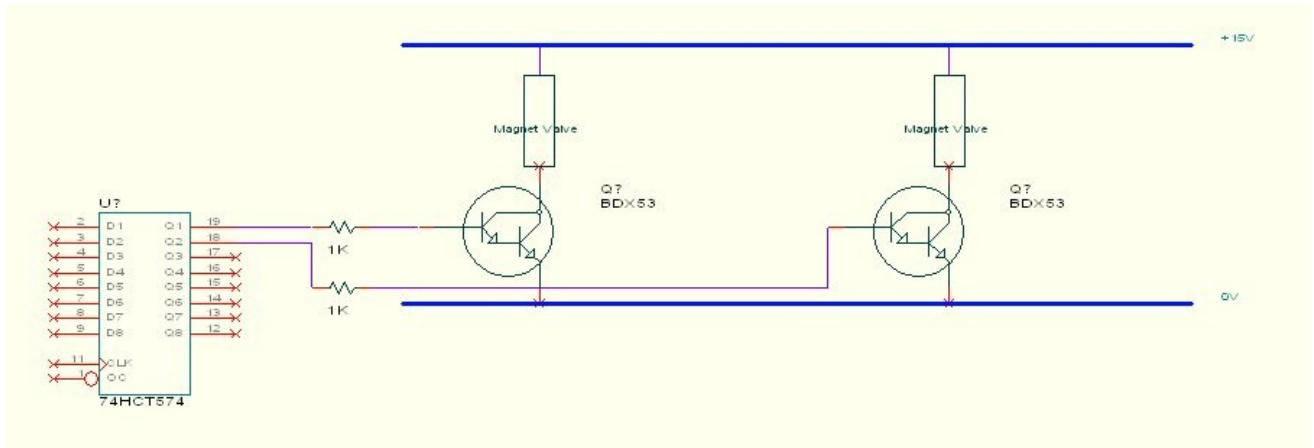
- For 1x64 and 2x64, magnets can be wired directly to the 64 pins connector board. The second magnet input being connected to +15V or 24V. One can add a diode between the +15V and the control pin.
- For 4x64 boards, magnets must have their own Darlington. Following the picture.



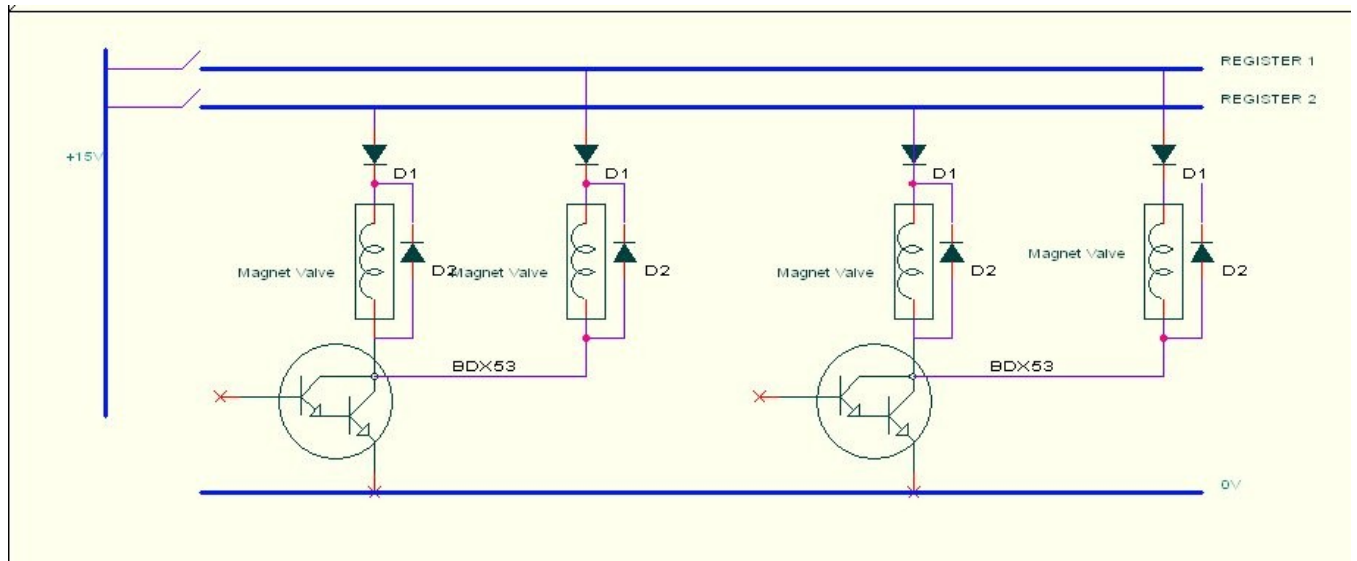
Multiple stops can be wired using several ways :

1/ THE MOST SIMPLE is a direct connection to the magnet.

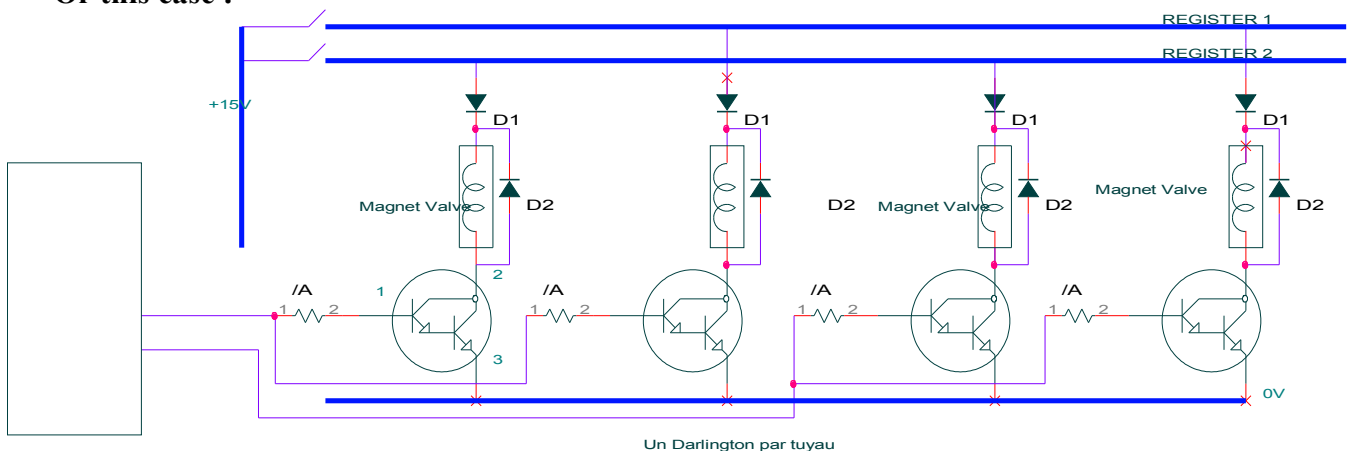
- The 1K resistor is on the O4x64 board. Use a Darlington on the magnet as showed above.
- The 2x64 can control directly the magnets. The only current limit is the heat dissipation of the PCB wires. Of course, 200-300mA magnets can be used without problem.
- One can use this system for unit or non unified ranks. I'm using 26 unt ranks on my own organ with a mix of 2x64 and 4X64. I prefer now 4x64 because in this case high currents are only present in the magnets, and not on the boards.



2. For more important organ configurations : One can control several magnets from a unique output.



Or this case :



D1 and D2 are anti-current return.

3/ DIODE MATRICES :

One can also use diode-matrices. Each magnet being at the node of the matrix. One can theoretically control $64 \times 64 = 4096$ magnets with 2 64 outputs. But this needs tests, because the control must be systematically refreshed at a fast rate.

TO CONCLUDE :

That's all !

With this electronic board set, one can build organs any sizes.

You can use also “**ORGAN DESIGNER SOFTWARE**” for windchest design and automated machine tool drilling, and “**ORGAN CONTROLLER SOFTWARE**” for controlling the input and output boards.

All these sets can be driven remotely, via a telecommunication line, or a cheap, long distance dual plug USB to Ethernet interface. (see our website : <http://pascal.leray.free.fr>).

PC to be used :

You have the choice : Whether you are using the 100MHz on board microprocessor, or the whole system can be controlled by a PC.

Any kind of PC.

You have only to connect to the Parallel Port interface. Or to a USB/MIDI output. Which can be directly connected to the 100MHz microprocessor which has a USB/MIDI direct input.

Any desktop or laptop or all-in-one PC can be used for controlling these boards. Add-on parallel boards can be added, with even dual parallel ports. Very cheap PC such as MINI ITX PC's can be used. Several screens and touch screens can also be used. All are supported by our “**ORGAN CONTROLLER SOFTWARE**”.

You can also add one or 2 unexpensive Touchscreens. My software can directly drive one or two touchscreens.



Boot duration process is less that 30s. Of course, one must load only a WINDOWS system without any add-in exe files.

It's the only constraint for the use of WINDOWS/PC based software. But really speaking, when we are switching “on” a classic organ, how much time do we spent for selecting our scores, waiting for the blower, switch the lights, and so on ?

ADVANTAGES :

Advantages # is huge:

- You become hardware independent, given the enormous PC offering worldwide.
- Memory extensions, disks, screens are very cost effective.
- Unlimited registration number.
- The PC world is very cost effective, due to the number of competitors.
- PC boards are using classical IC components, such as 74541, 74574, which are always available worldwide.
- These component never fail.
- Use a battery based inverter, and you'll become independent of any overvoltage.
- **SOFTWARE FLEXIBILITY : thanks to ORGAN CONTROLLER, many features are now available WITHOUT ADDITIONAL HARDWARE:**
 - Transposer
 - MIDI inputs and outputs
 - Displayed registration number.
 - Tremulant : variable frequency, for each register.
 - Pedal split
 - Multiple registration set per organist, defined as PC files.
 - Expressive sensitive keyboard keys.
 - Envelope curve.
 - Flexible drawstops display
 - Real drawstops and pistons can also be used.
 - Copy – Paste of registrations
 - Name for registrations.
 - Unlimited copulas.
 - All registers can be actuated from any keyboards
 - Independently of other keyboards : for example a trumpet can be actuated at the pedal,
 - Each keyboard can be defined with the stops you want. (can be defined by organbuilders or organists).
 - Mixturs can be defined by text files.
 - All stops can be actuated in 16', 8', 4' 2' feet and even tierce, quint, and so on.
 - Reed Mixturs can also be programmed, thanks to a simple text file. (see below).

ORGAN DESIGNER SOFTWARE :

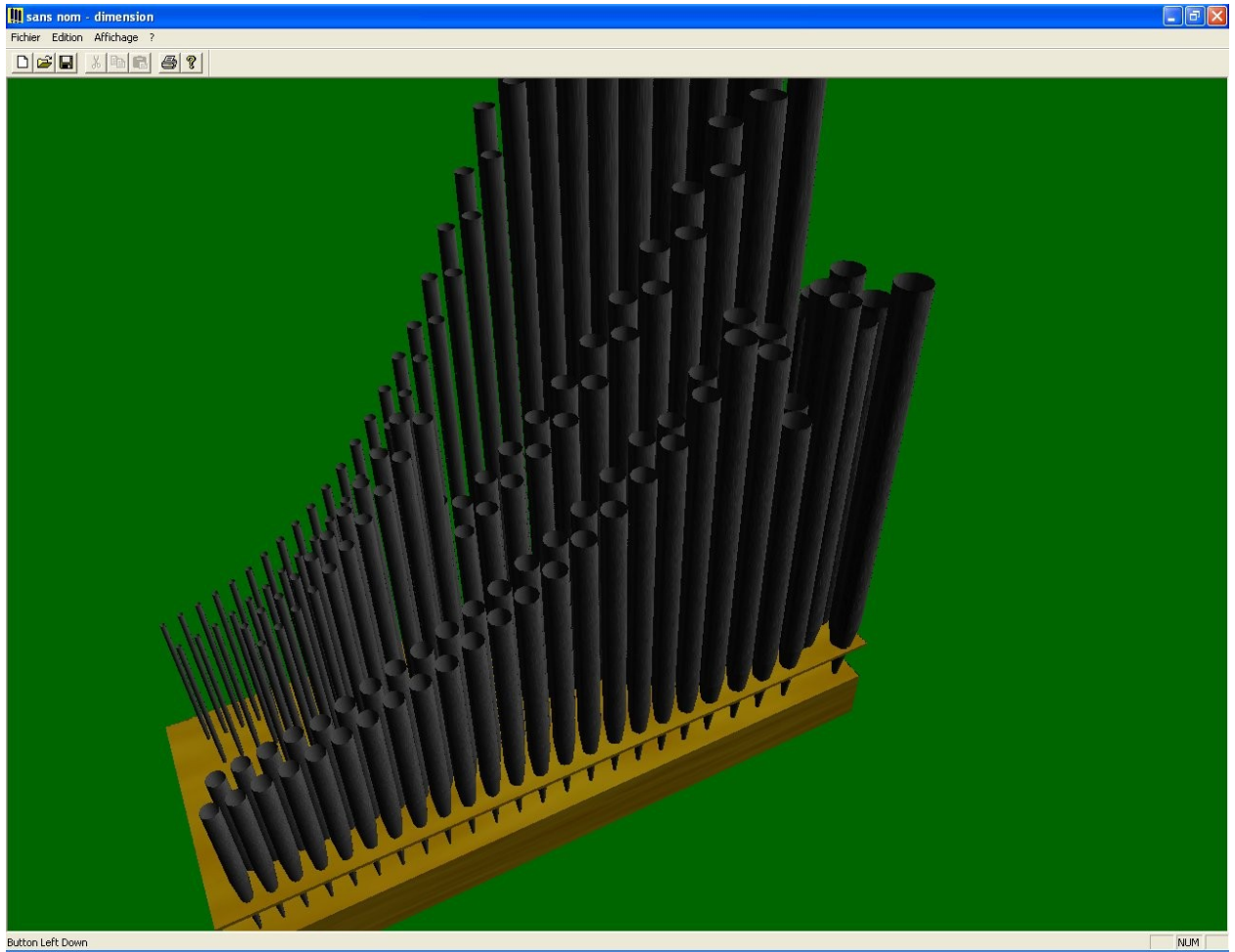
If you want to design a real chest, you can use my Organ Designer Software :

This software is able to create a real chest, with a 3D viewer, and can directly control a CNC machine. A 6 ranks chest is created in less than one hour !

Watch :

http://pascal.leray.free.fr/projet/cao_sommiers_en.html

Example :



ANNEX 1 : Options.wri file (example)

Here is an example of how register addresses are simply defined for each register.
This file fully describes a real Pipe Organ, and the control screen.

```
PORT_BASE 378
PORT_BASE_HALL 378
SCREENS 2
STOPS 24
BOURDON ; FF; BOARD1X64; FLUTE
FLUTE 4 ; F7; BOARD1X64; FLUTE
FLUTE 8 ; CF; BOARD1X64; FLUTE
MONTRE ; EF; BOARD1X64; PRINCIPAL
DULCIANE ; C7; BOARD1X64; FLUTE
NAZARD ; D7; BOARD1X64; FLUTE
SOUBASSE ; 7F; BOARD1X64; FLUTE
PRESTANT ; 27; BOARD1X64; PRINCIPAL
QUINTATON ; 3F; BOARD1X64; FLUTE
DOUBLETTE ; 2F; BOARD1X64; FLUTE
REGALE ; AF; BOARD1X64; REED
HAUTBOIS ; B7; BOARD1X64; REED
TROMPETTE ; E7; BOARD1X64; REED
VOX HUMANA ; DF; BOARD1X64; REED
FLUTE_HARM ; 4F; BOARD4X64; FLUTE
BOURDON4 ; A7; BOARD4X64; FLUTE
GAMBE ; BF; BOARD4X64; FLUTE
CORNET ; 00; BOARD4X64; FLUTE
PLEINJEU ; 00; BOARD4X64; MIXTUR
FOURNITURE ; 87; BOARD4X64; MIXTUR
CROMORNE ; 0F; BOARD4X64; REED
VCELESTE ; 07; BOARD4X64; FLUTE
TROMPETTE4 ; 37; BOARD4X64; REED; T
TIERCE ; 47; BOARD4X64; PRINCIPAL; t
```

ANNEX 1 : MIXTUR EXAMPLE :

Any complex mixture can be created thanks to a file similar to this example.
Such as : Fourniture, Cymbale, Plein Jeu, Sesquialtera, etc...

VIRTUAL REGISTER EXAMPLE

Fourniture dax 4 rank n°1 (keyboard GO)

" l= LARIGOT " " p= PRESTANT4 " M=MONTRE

```
1 32 M 37 M 44 M
2 33 M 38 M 45 M
3 34 M 39 M 46 M
4 35 M 40 M 47 M
5 36 M 41 M 48 M
6 37 M 42 M 49 M
7 38 M 43 M 50 M
```

8 39 M 44 M 51 M
9 40 M 45 M 52 M
10 41 M 46 M 53 M
11 42 M 47 M 54 M
12 43 M 48 M 55 M
13 37 M 44 M 49 M
14 38 M 45 M 50 M
15 39 M 46 M 51 M
16 40 M 47 M 52 M
17 41 M 48 M 53 M
18 42 M 49 M 54 M
19 43 M 50 M 55 M
20 44 M 51 M 56 M
21 45 M 52 M 57 M
22 46 M 53 M 58 M
23 47 M 54 M 59 M
24 48 M 55 M 60 M
25 49 M 56 M 61 M
26 50 M 57 M 62 M
27 51 M 58 M 63 M
28 47 M 52 M 59 M
29 48 M 53 M 60 M
30 49 M 54 M 61 M
31 50 M 55 M 62 M
32 51 M 56 M 63 M
33 52 M 57 M 64 M
34 53 M 58 M 65 M
35 54 M 59 M 66 M
36 55 M 60 M 67 M
37 56 M 61 M 68 M
38 57 M 62 M 69 M
39 58 M 63 M 70 M
40 52 M 59 M 64 M
41 53 M 60 M 65 M
42 54 M 61 M 66 M
43 55 M 62 M 67 M
44 56 M 63 M 68 M
45 57 M 64 M 69 M
46 58 M 65 M 70 M
47 59 M 66 M 71 M
48 60 M 67 M 72 M
49 61 M 68 M 73 M
50 62 M 69 M 74 M
51 63 M 70 M 75 M
52 64 M 71 M 76 M
53 65 M 72 M 77 M
54 66 M 73 M 78 M
55 67 M 74 M 79 M
56 68 M 75 M 80 M
END