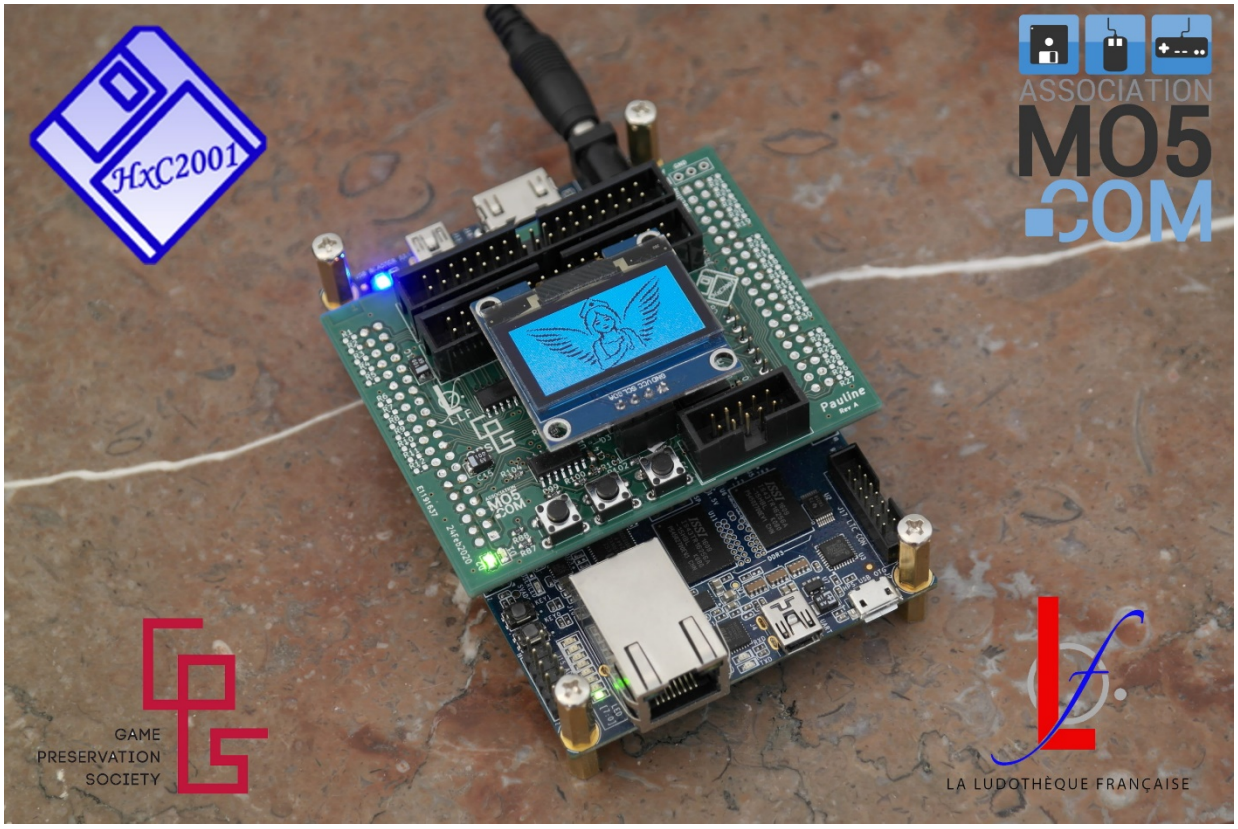


USER MANUAL
PAULINE

TABLE OF CONTENTS

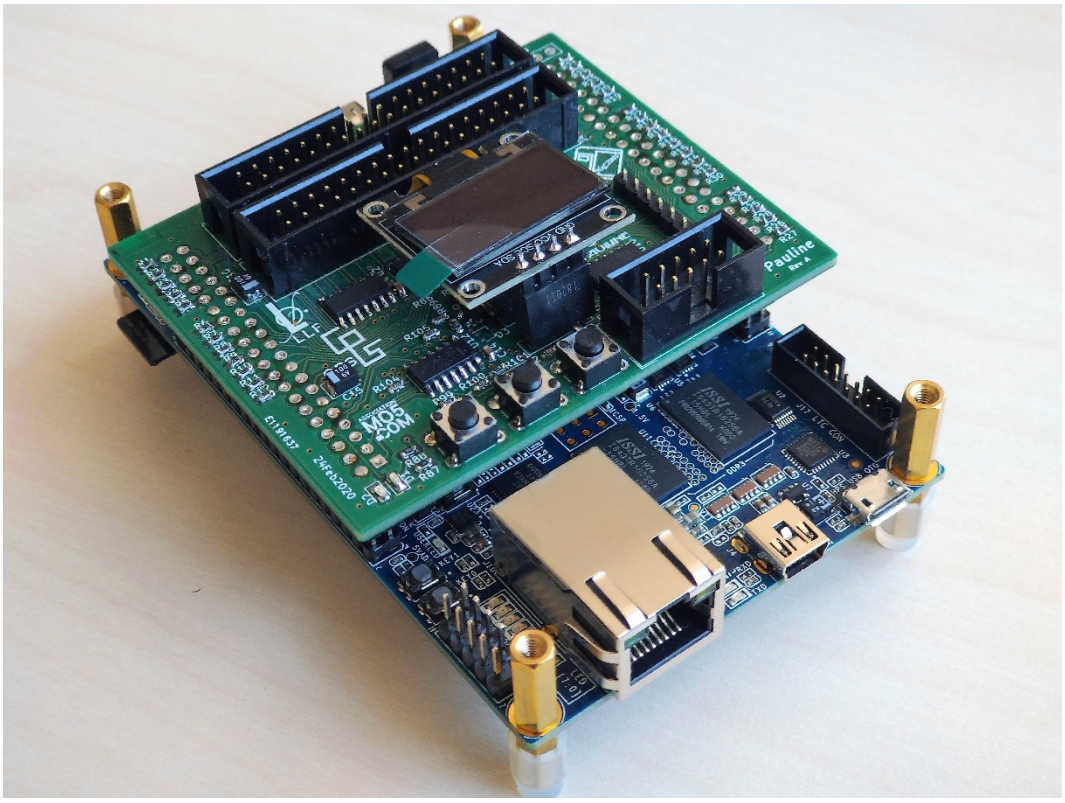
Content

What is Pauline?

Pauline is a tool developed by Jean François Del Nero, also author of the very famous HxC tool, within the association La Ludothèque Française, in partnership with the associations Game Preservation Society located in Japan, and MO5.COM located in France.

Pauline is a totally open-source, powerful, universal and simple to use tool that will allow you to scan with precision the content of the magnetic disks you want to archive, regardless of their format.

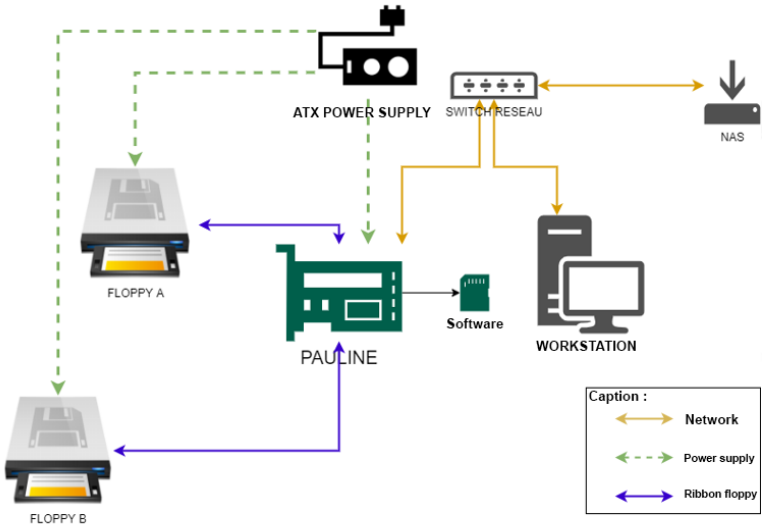
Pauline, finally, is based on a commercially available hardware solution, a DE10-Nano FPGA board and a daughter board whose plans and BOMs are given on the SourceForge site, as well as a software solution that is also open-source and still available on Pauline's SourceForge.



Pauline Rev A mounted on her DE10-Nano and OLED display (August 2020)

Pauline, whose name of use stipulates the set consisting of a DE10-Nano card with its daughter card "Pauline", will interface with your floppy disk drives, whatever their format (3, 3.5, 5.25, 8 inches or other) and will allow you in just a few clicks to scan their content and archive it.

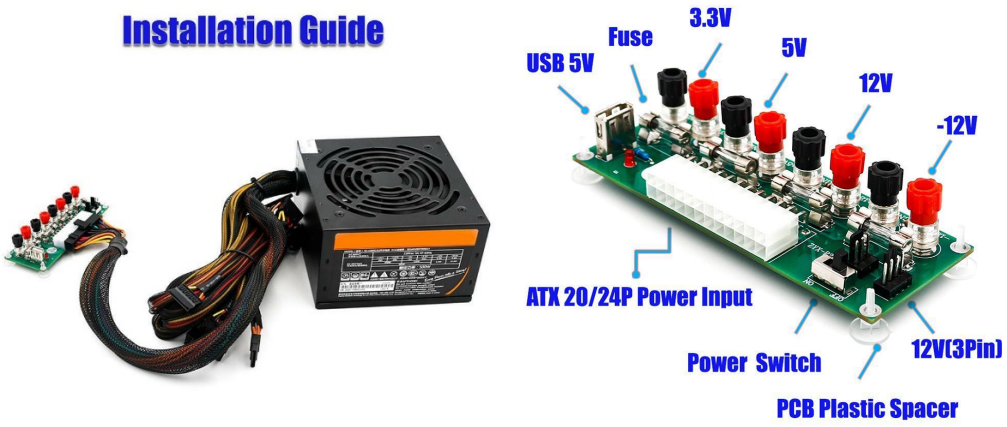
WHAT IS PAULINE?



Connection diagram of a Pauline card

Your Pauline will therefore interface with several floppy disk drives of various formats.It is important to note here that, as shown in the diagram above, we recommend that Pauline and the floppy disk drives share the same power supply (by default, a modern ATX-type PC power supply), in order to limit possible problems of differences in electrical voltage (common ground).

In order to be able to easily connect all these components to an ATX power supply (choose quality over power, of course), here is a small device available on the market that allows to link all floppy drives and Pauline to the same power supply easily :



A standard ATX power supply unit with 20/24Pin ATX Benchtop PC Power Adapter Board

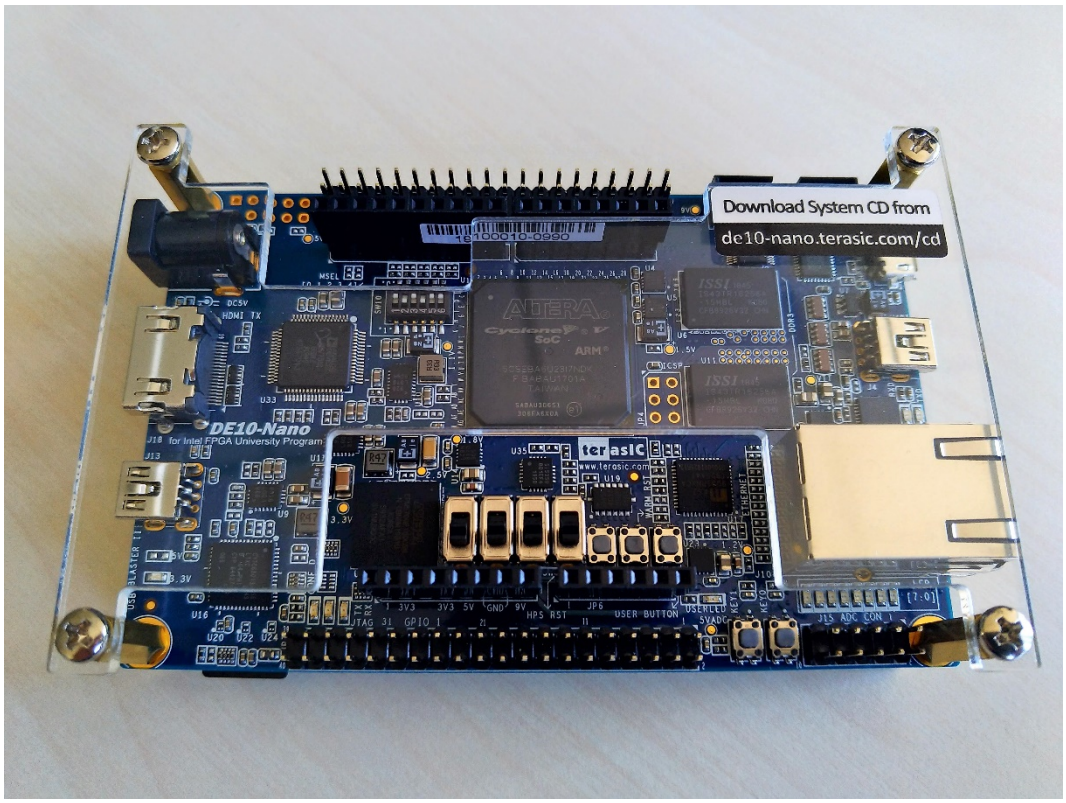
What are the components of Pauline ?

Pauline is a set of several technical and software elements that will allow you to scan with precision your magnetic disks, whatever their format.

Pauline uses a technical platform known as DE10-Nano in order to be efficient and to be able to work in an autonomous way, out of sync with a conventional computer, which we briefly present :

THE DE10-NANO

It is an electronic board built around a high-performance fifth-generation FPGA chip, and two ARM cores capable of running one OS (Linux, other). It is also equipped with an HDMI output (not yet used at this stage of the project), an RJ45 Gigabit network socket, USB connectors and GPIO (General Purpose Input/Output) connectors capable of receiving different electronic boards and dialoguing with the outside world.



A DE10-Nano card (July 2020)

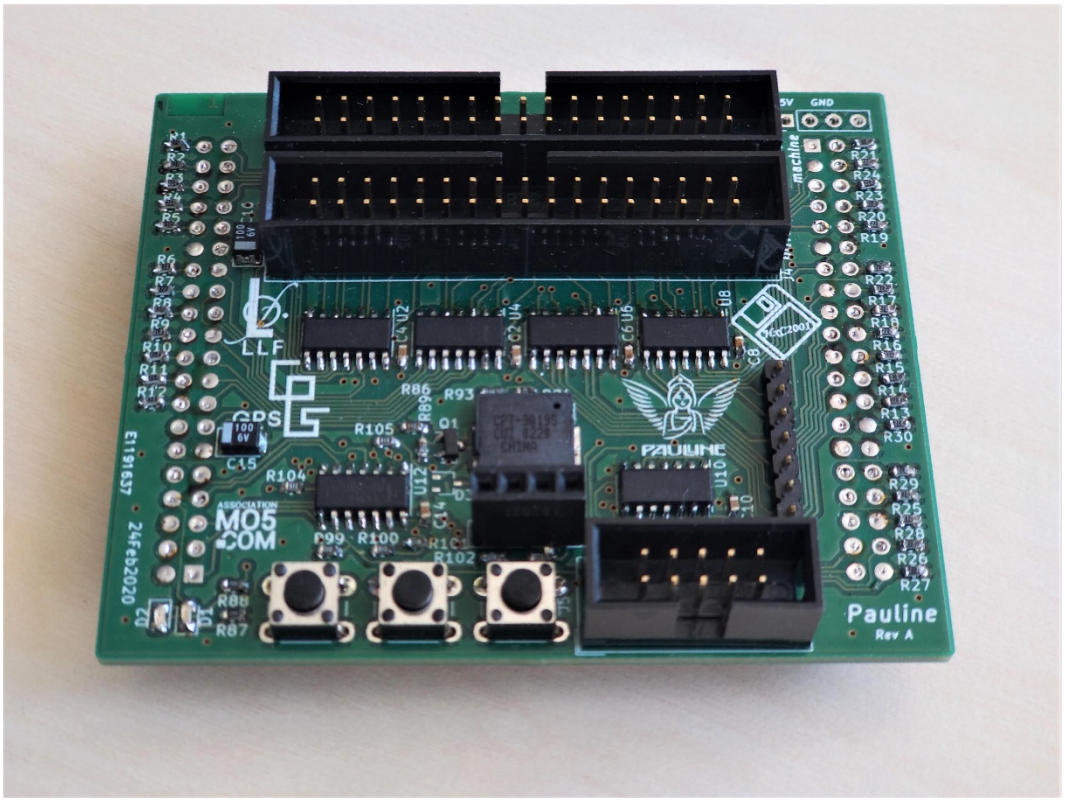
This card is available for around €130 according to commercial sites (public prices as of July 2020), for example at Digi-Key : https://www.digikey.fr/fr/product-highlight/t/terasic-tech/de10-nano

WHAT ARE THE COMPONENTS OF PAULINE ?

Pauline is therefore, as you will have understood, a daughter board that will be grafted on the DE10-Nano board, directly on the GPIO connectors, located at the top and bottom on the picture above.

THE PAULINE CARD

This one is composed of several connectors that will allow to control floppy disk drives in Shugart data format (up to 4 drives). A 4-pin connector located in the center of Pauline allows the use of a small 0.96 inch OLED screen which will help to make an immediate diagnosis of Pauline and the operations in progress. Finally, three buttons will in the future also allow to interact quickly with Pauline's functionalities.



Pauline revision A (July 2020)

Pauline's assembly

Now that you have received all the materials necessary for Pauline's functioning, we will see together how to arrange them in order to start Pauline. Don't hesitate to ask for help again on the Discord of La Ludothèque Française or MO5.COM if you encounter any difficulty (see last chapter of this document).

PREPARATION OF ALL COMPONENTS

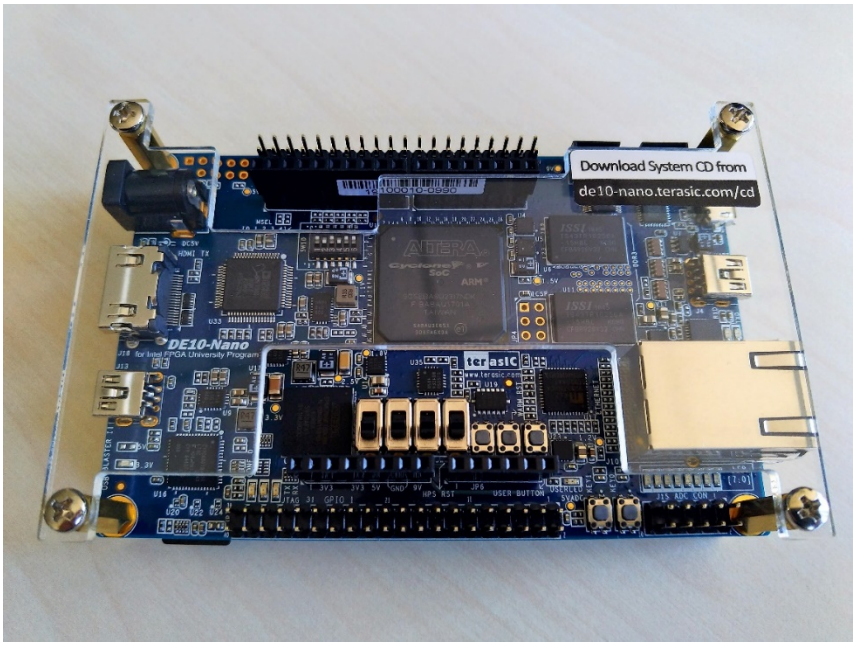
Measure the thickness of the document using a micrometer...
First check that you have received a complete DE10-Nano card, including the card, power supply, manuals and necessary cables, as shown here :

Contents of the box of a complete DE10-Nano card in July 2020

Then, take out its power supply, taking care to add an adapter for French electrical plugs. Note that you can use any 5V USB power supply but with a minimum capacity of 2 amps.

Original power supply of the DE10-Nano card and its adapter for French plugs

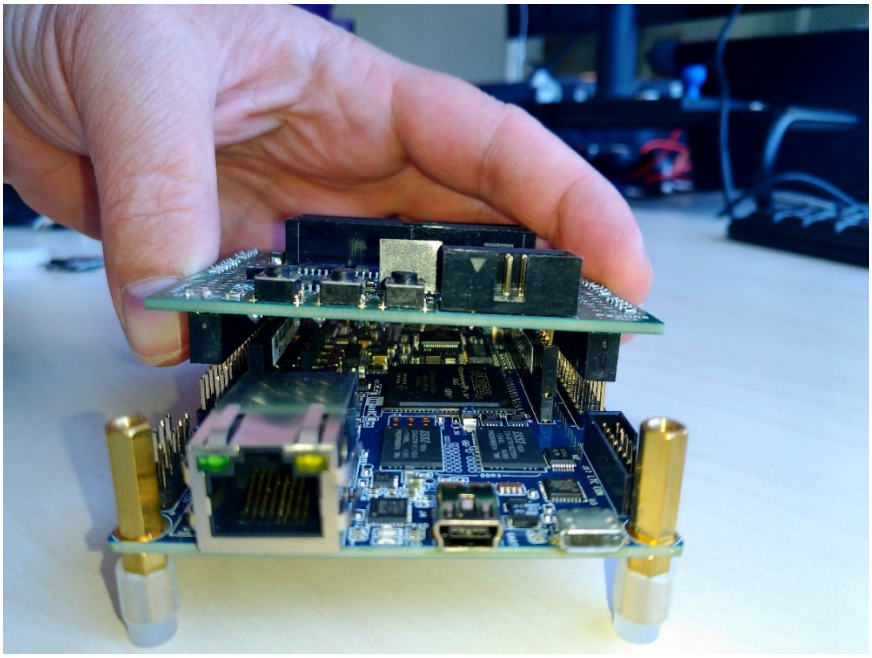
The DE10-Nao card is presented in this form once extracted from its protective packaging:



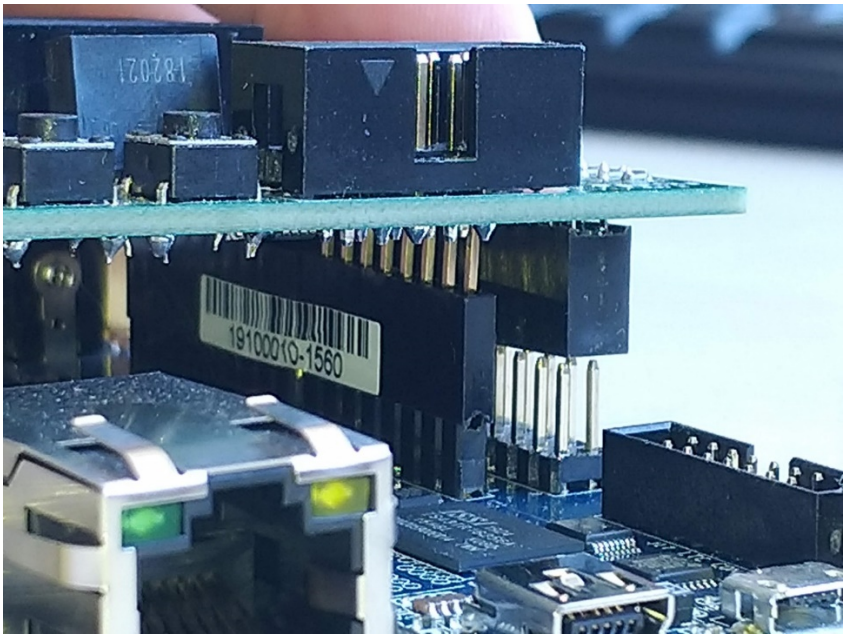
The additional OLED screen that we offer you to purchase is in this form. Note this reference and seller if you wish.

ASSEMBLY OF THE PAULINE CARD ON THE DE10-NANO

Take delicately between two fingers the daughter card Pauline, and present it above the DE10-Nano card as follows :

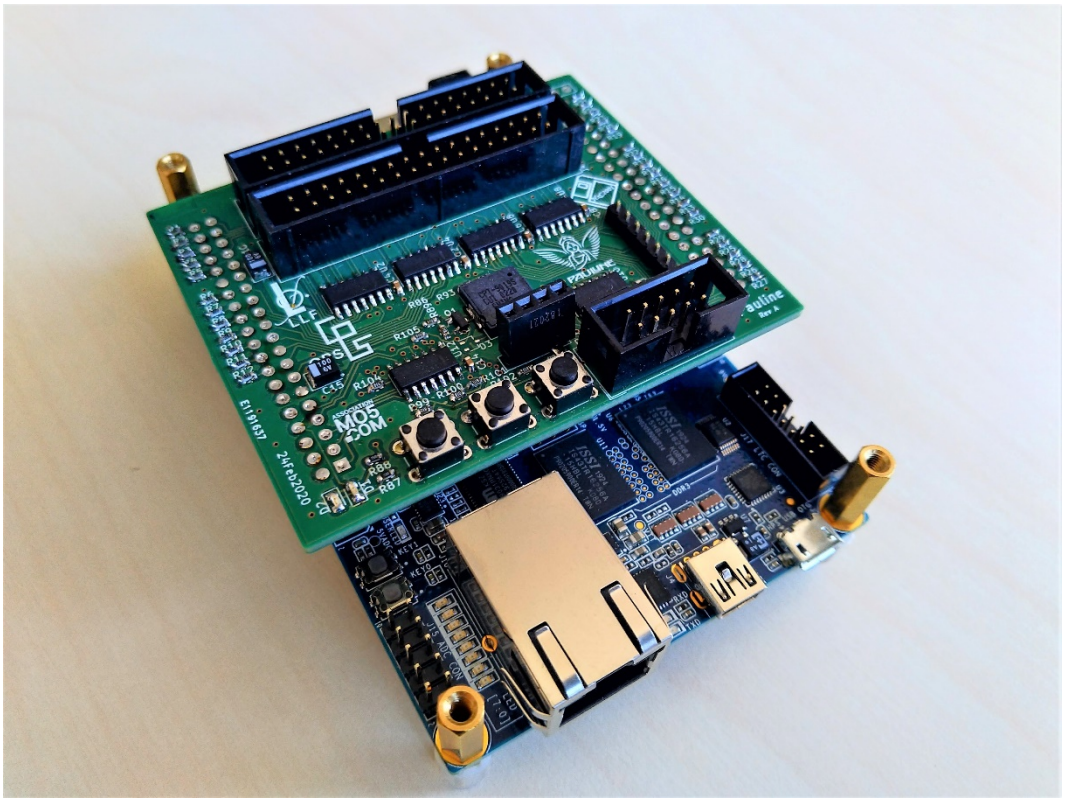


Then, make sure that the connectors of the daughter board are facing the connectors of the DE10-Nano board :



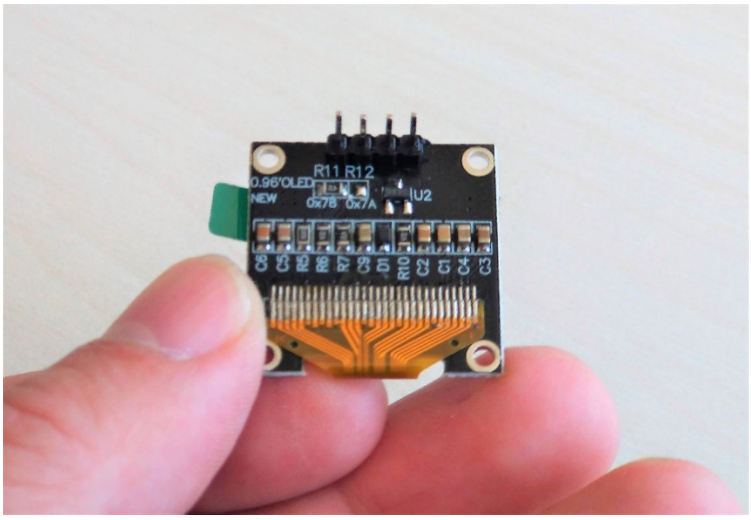
PAULINE'S ASSEMBLY

You should get the following setup :



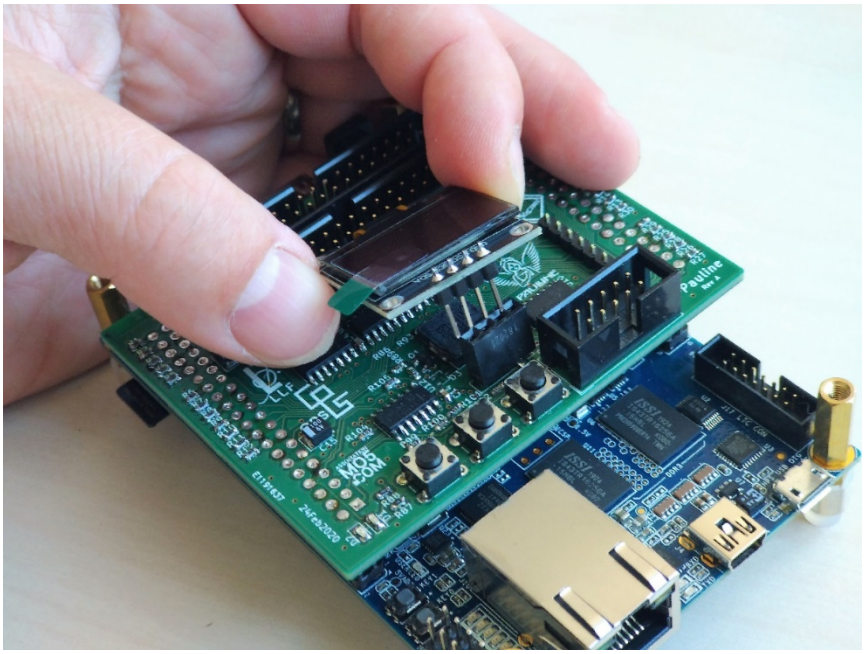
ASSEMBLY OF THE OLED SCREEN

The optional OLED display is very simple to set up, and works only with 4 pins to be placed in Pauline.

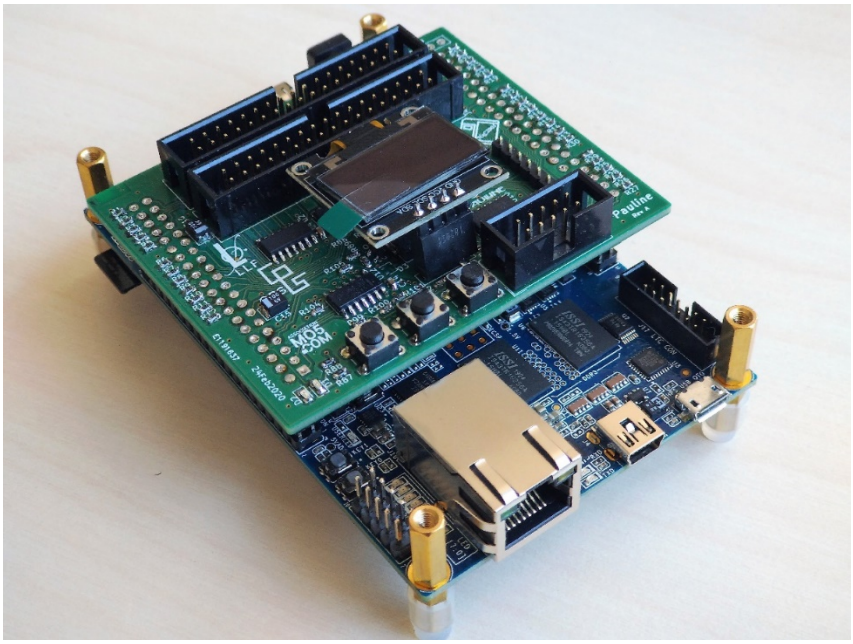


PAULINE'S ASSEMBLY

Take the screen between two fingers and slide its pins into Pauline like this :



Congratulations, your Pauline is now complete !

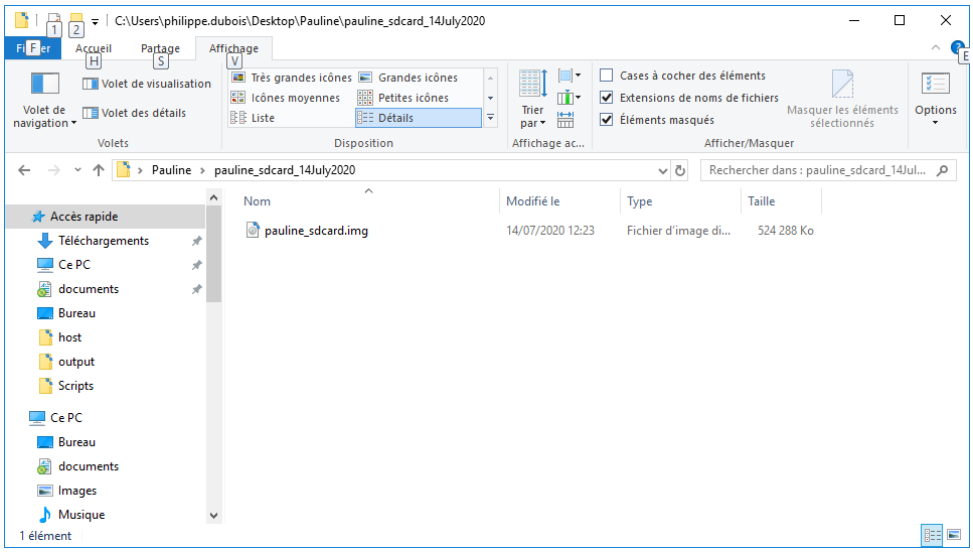


Preparing the Firmware's MicroSD card

The DE10-Nano card comes with an 8GB MicroSD card. This capacity is more than enough for Pauline's work. However, it needs to be formatted with the Linux work environment prepared for Pauline and her operating tools.

First of all, get the latest Pauline's firmware from Jean-François Del Nero's website : https://hxc2001.com/pauline/

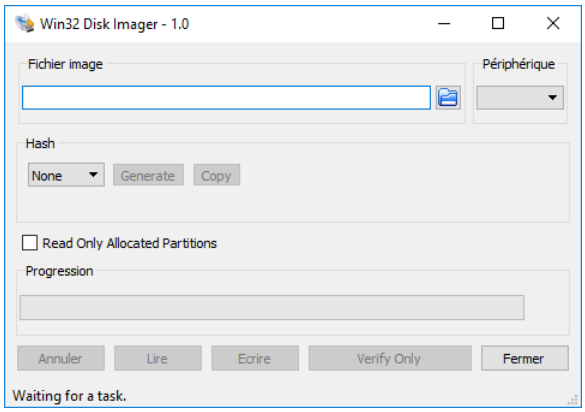
Unzip the file into a directory, which should give you access to the following file :



Then, if you are in a Windows environment, download the free Win32DiskImager tool :

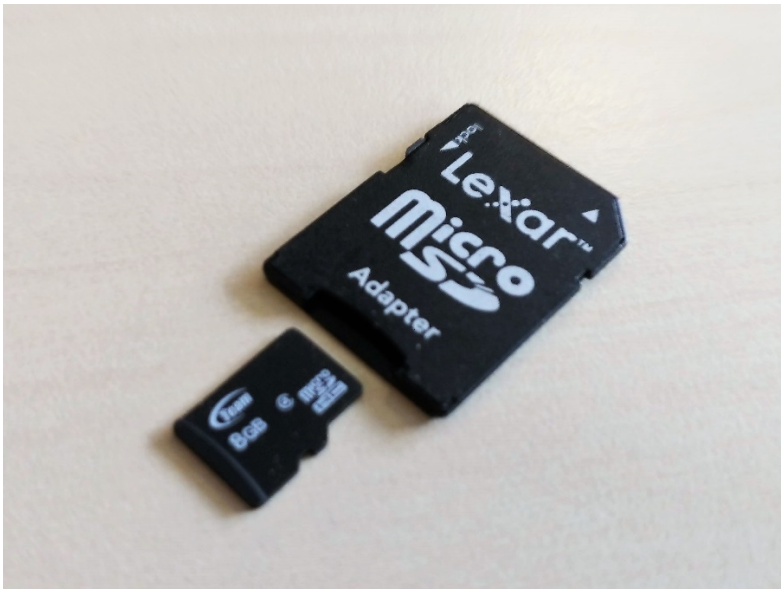
https://sourceforge.net/projects/win32diskimager/

Proceed with the installation and then launch the tool. The following window should appear :

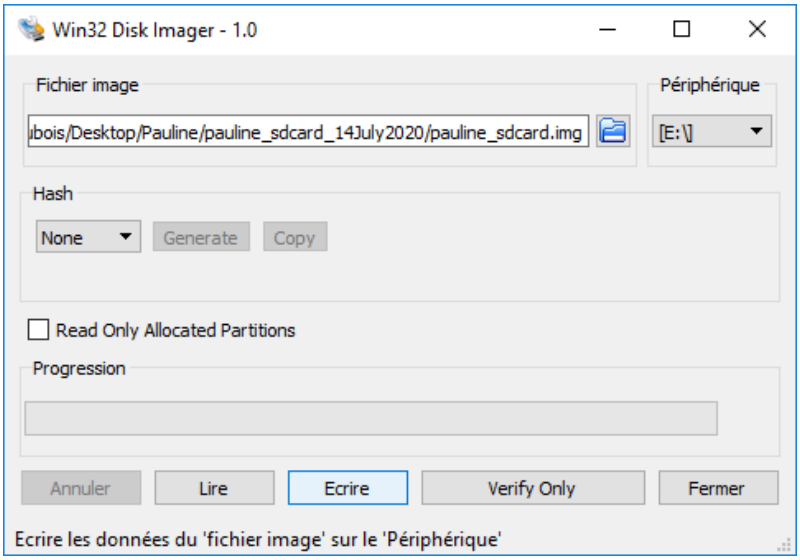


PREPARING THE FIRMWARE'S MICROSD CARD

Insert the MicroSD card into your computer, and if you don't have a special slot for this, you can use for example this MicroSD to SD adaptor :

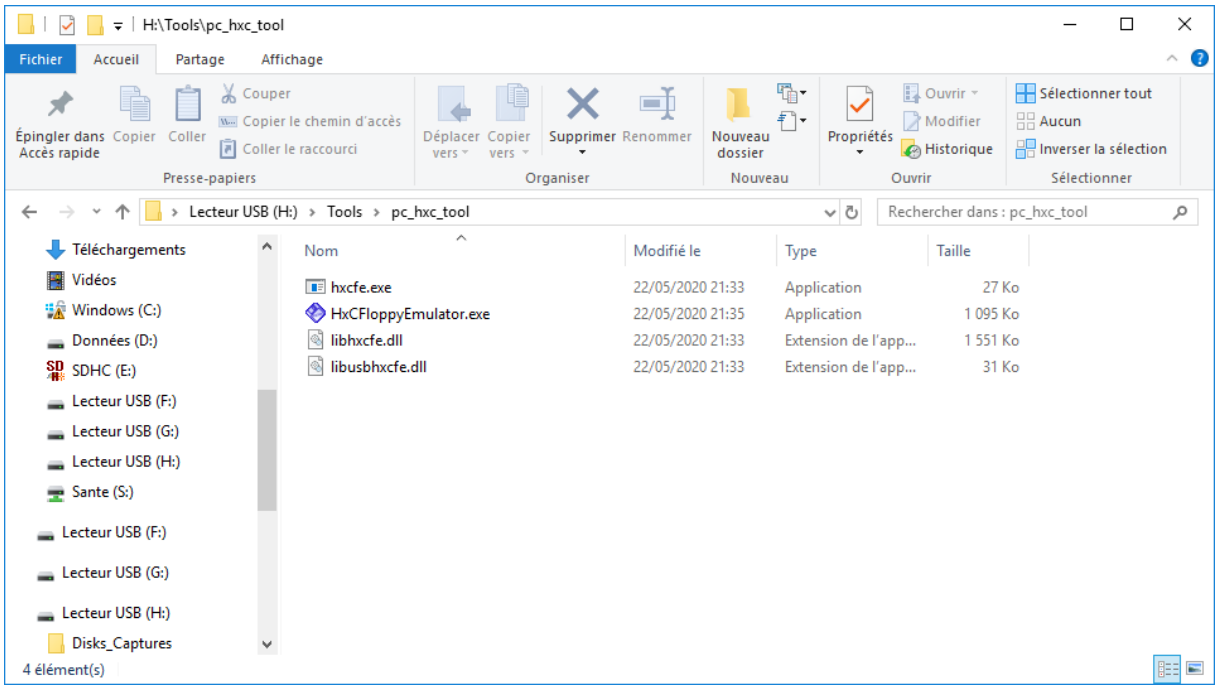


Then, select Pauline's firmware file unzipped just beforehand

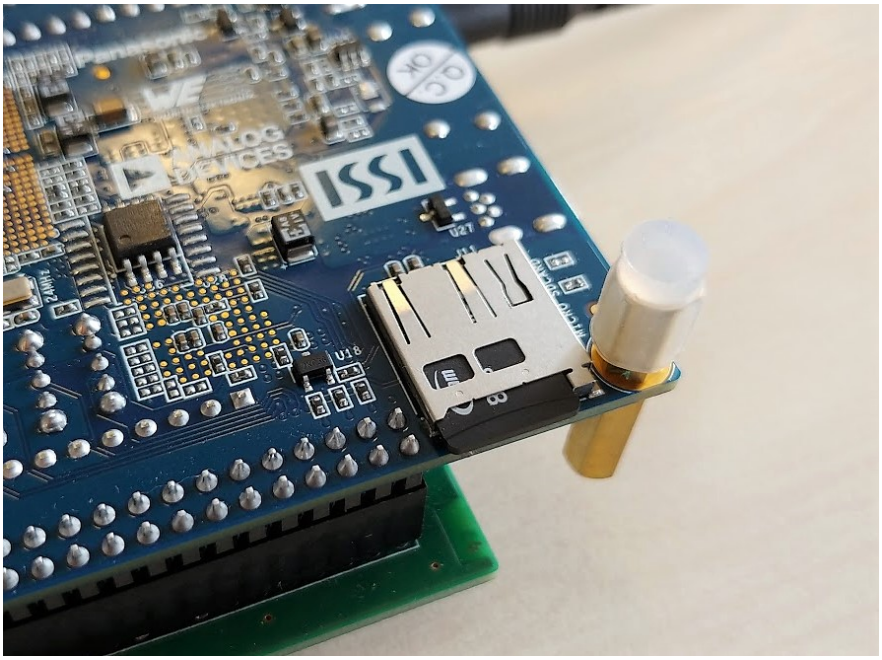


Press the "Write" button and wait until the end of the operation, where you should receive a "Write successful" message.

PREPARING THE FIRMWARE'S MICROSD CARD



Then insert the updated MicroSD card into the DE10-Nano card as follows :

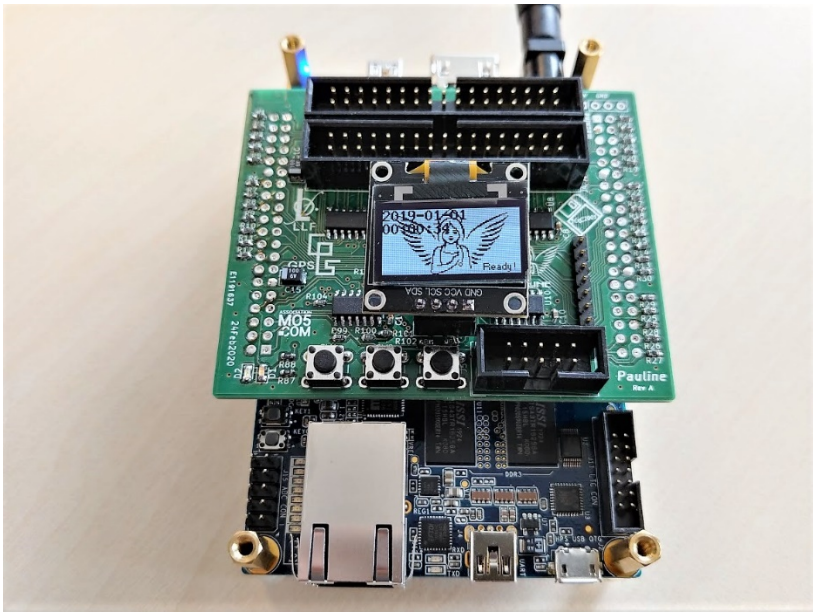


Push in MicroSD card until you feel a click, with the tip of a fingernail, for example, into its holder.

First launch of Pauline

The assembly of your Pauline is finished ! It's time to turn it on and allow it to wake up for the first time. Make sure you have inserted the MicroSD card updated with Pauline's firmware, then insert the power supply of the DE10-Nano card.

After a few seconds, you should get a small beep and the following screen :



Your Pauline is ready and functional, congratulations !

We will now configure it to work on your network and with your floppy drives.

Test procedure « Pauline – Test – Interface »

Before you start using Pauline, it is important to check that everything is correctly installed on the card.

For this we will use the internal test procedure of the card. To implement it we will need to go through the command line with a communication software : « Putty »

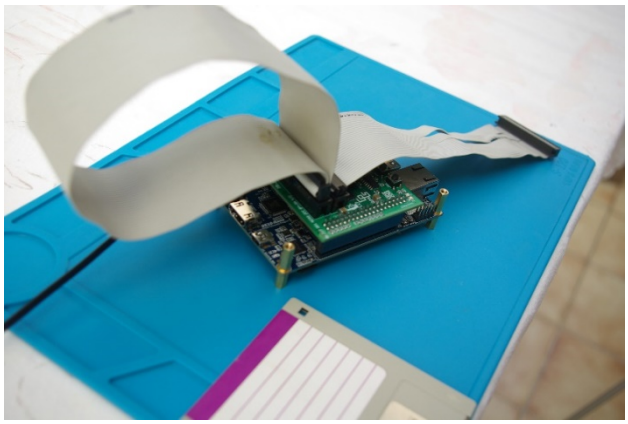
https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html

If you do not wish to install all the software that make up the Putty package with "Windows installer", a version without installation is available :
https://the.earth.li/~sgtatham/putty/latest/w64/putty.zip

You can also download only « Putty.exe », which is only used for this procedure.

https://the.earth.li/~sgtatham/putty/latest/w64/putty.exe

Connect a straight floppy cable between the 2 connectors J3 (host) and J4 (drives).



See the appendices for some information on ribbon cables.

Plug a network cable for Pauline to get an IP address.

Turn on Pauline, the IP address is displayed on the OLED screen. Example: 192.168.1.28

TEST PROCEDURE « PAULINE – TEST – INTERFACE »

Launch Putty

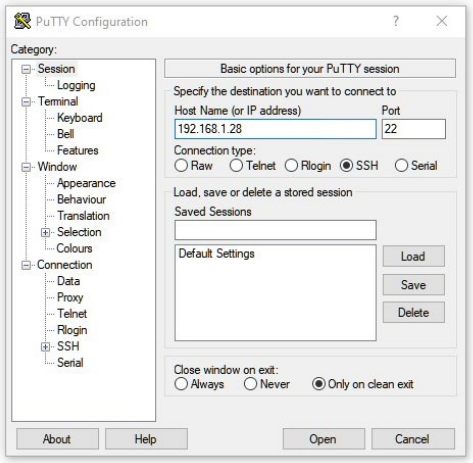
In Putty, fill in the IP address and Port fields.

Example :

IP address :
192.168.1.28

Port : 22

Tick « SSH »



As a reminder, here are the default username and password used to connect to Pauline:

- SSH (Login/pwd : pauline/pauline, Login/pwd : root/root)

- FTP (Login/pwd : pauline/pauline, Login/pwd : root/root)

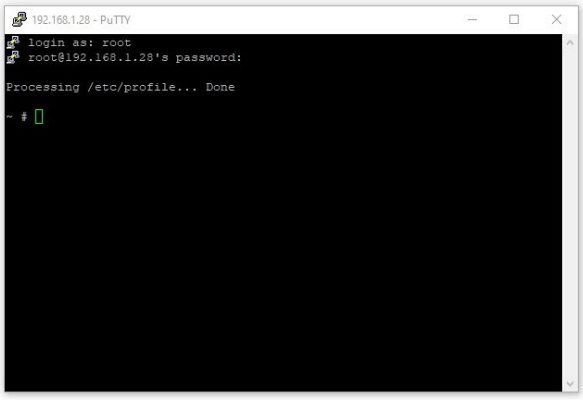
- Samba / Windows shares (Login/pwd : pauline/pauline)

Click on the button « Open »

A terminal windows opens: login as :

Enter « root » and « root » for password

Password is not displayed while typing



TEST PROCEDURE « PAULINE – TEST – INTERFACE »

FIRST TEST

Enter « pauline -test_interface »

The test will test the floppy interfaces, the leds, the buzzer, the additional IO port.

```
~ # pauline -test_interface
HxC Floppy Emulator : Pauline floppy drive simulator / floppy drive dumper control software v1.0.0.0
Copyright (C) 2006-2020 Jean-Francois DEL NERO
This program comes with ABSOLUTELY NO WARRANTY
This is free software, and you are welcome to redistribute it
under certain conditions;

Host -> Floppy test
(00) OK !
(03) OK !
(13) OK !
(14) OK !
(15) OK !
(17) OK !
(22) OK !
(26) OK !
(27) OK !
(28) OK !
Floppy -> Host test
(01) OK !
(02) OK !
(04) OK !
(05) OK !
(06) OK !
(07) OK !
(08) OK !
(09) OK !
(10) OK !
(11) OK !
(12) OK !
(16) OK !
(18) OK !
(19) OK !
(20) OK !
(21) OK !
(23) OK !
(24) OK !
(25) OK !
(00) (0x1) 0x1   (0x1|)0x1 (0x2|)0x3 (0x4|)0x5 (0x8|)0x9    0xF
(01) (0x2) 0x2   (0x1|)0x3 (0x2|)0x2 (0x4|)0x6 (0x8|)0xA    0xF
(02) (0x4) 0x4   (0x1|)0x5 (0x2|)0x6 (0x4|)0x4 (0x8|)0xC    0xF
(03) (0x8) 0x8   (0x1|)0x9 (0x2|)0xA (0x4|)0xC (0x8|)0x8    0xF

1 -> 1
0 -> 0
PB1:1 PB2:1 PB3:1 INT:1
```

At the end there are a few seconds to test the buttons :

Then press the buttons to switch the PBx to zero.

TEST PROCEDURE « PAULINE – TEST – INTERFACE »

The LEDs should flash during the first part of the test, and the buzzer should « beep ».

Check that the IO part gives this :

```
(00) (0x1) 0x1   (0x1|)0x1 (0x2|)0x3 (0x4|)0x5 (0x8|)0x9    0xF

(01) (0x2) 0x2   (0x1|)0x3 (0x2|)0x2 (0x4|)0x6 (0x8|)0xA    0xF

(02) (0x4) 0x4   (0x1|)0x5 (0x2|)0x6 (0x4|)0x4 (0x8|)0xC    0xF

(03) (0x8) 0x8   (0x1|)0x9 (0x2|)0xA (0x4|)0xC (0x8|)0x8    0xF
```

SECOND TEST (OPTIONAL)

If everything is Ok, you have the possibility to check one last point on your card

This test is optional as it requires a little hardware and some electronic skills - see the appendix for the procedure.

Everything is OK, let's move on to the next step : the configuration of Pauline's interfaces.

Setting Pauline to floppy disk drives connected

Depending on the type of drives connected to Pauline (Shugart or PC Drive), the "MOTOR_LINE" and "SELECT_LINE" commands must be set.

See the appendices for the assignments of the connectors according to their positions on the 34-pin floppy cable.

Access the content of the SD CARD in an external port, via FTP or SAMBA network share.

(see page 15 for username and password)

In the folder \pauline\Settings

Edit the file « drives.script »

If you are using « Shugart » drive

This technology can have 4 differents select lines and 1 motor line.

The motor-on is common to all floppy drive on the same bus.

If you are using « PC Floppy disk drives »

Pauline allows to control 2 drives.

Drive A and Drive B

Example with the use of a 3.5 inch PC drive

```
set DRIVE_0_DESCRIPTION "3.5-inch Floppy drive"
set DRIVE_0_SELECT_LINE DRIVES_PORT_DRVSA
set DRIVE_0_MOTOR_LINE  DRIVES_PORT_MOTEA
set DRIVE_0_MAX_STEPS   82
```

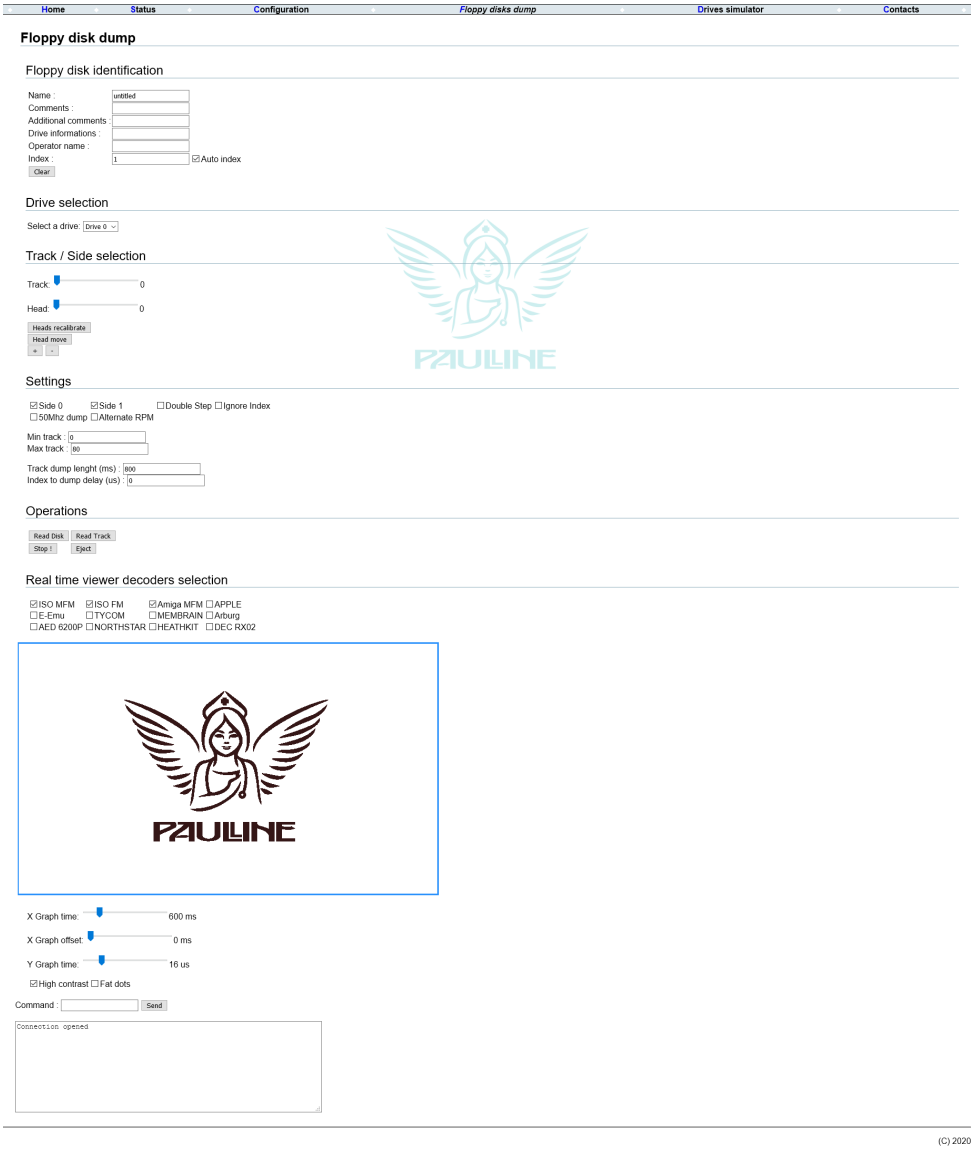
See the "drives_script_base.txt" file in the \pauline\Settings folder on the SD card for more information.

Setting « HxCFloppyEmulator »

Several possibilities to control Pauline.

WEB INTERFACE

By using Pauline's IP address in a web browser, you can connect to the http service.



SETTING « HXCFLOPPYEMULATOR »

WITH « HXCFLOPPYEMULATOR »

Download HxCFloppyEmulator

https://hxc2001.com/download/floppy_drive_emulator/HxCFloppyEmulator_soft_beta.zip

Unzip the ZIP archive, find and edit the file "config.script".

Change the default IP address to your IP address displayed on Pauline's screen.

In our example Pauline's IP is 192.168.1.28, the line is modified :

```
set PAULINE_DEFAULT_IP_ADDRESS "192.168.1.28"
```

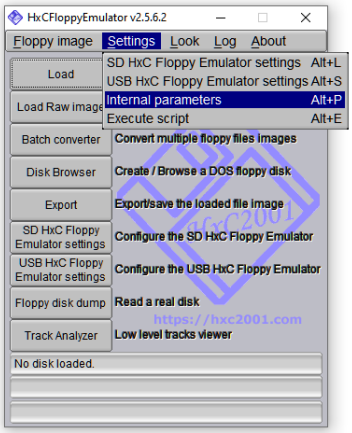
Save the file.

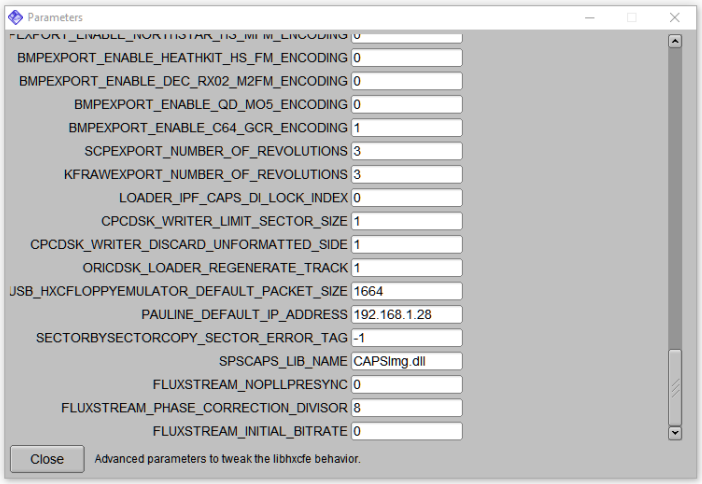
2nd Method in HxCFloppyEmulator

Launch HxCFloppyEmulator.exe.

Go to « Settings », « Internal Parameters »

Edit line « PAULINE_DEFAULT_IP_ADDRESS » => 192.168.1.28





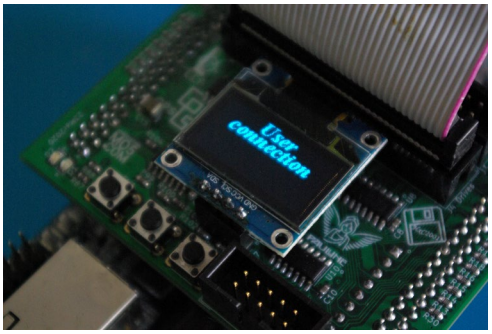
Your first "dump" under HxCFloppyEmulator

Launch HxCFloppyEmulator.exe

Launch Ludo Floppy Disk Toolkit => « Floppy image » then « Pauline control interface » or shortcut keys « ALT + P »

Check the displayed IP address, click on « Connect »,

« Connected » is displayed in the « Status » section



« User connection » should appear on Pauline's oled screen

Choose the « Disk drive » number adapted to your connection configuration of the drive(s).

Click on « recal », if all is well the floppy disk drive, must do a reset operation of the reading head (Heads recalibrate).

Using the « Track/Side selection » slider and the « move » button you can move the head to the desired location.

Don't forget "Double step" tick button option, moving the head to the next track or half track, as you wish.

(double step to create 48tpi 40 track diskettes on 5.25 inch drives)

Be careful not to exceed the physical capabilities of your player.

YOUR FIRST "DUMP" UNDER HXCFLOPPYEMULATOR

Finally the stream dump ...

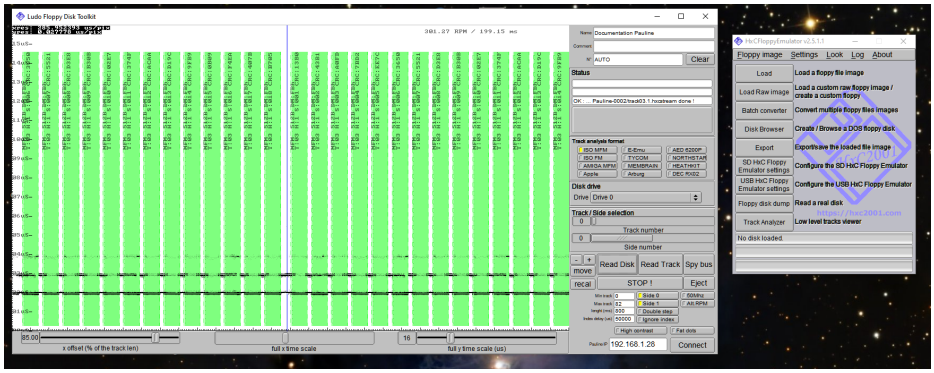
Fill in the descriptive information on the diskette (Name, Comment and No.).

Insert a floppy disk in the drive.

Press the « recal » button to be sure to start on side 0 / track 0.

Choose the « track analysis format » adapted to the format of your floppy disk to have a real-time visualization of the integrity of the data read.

Start the stream dump by pressing the "Read Disk" button, playback starts.



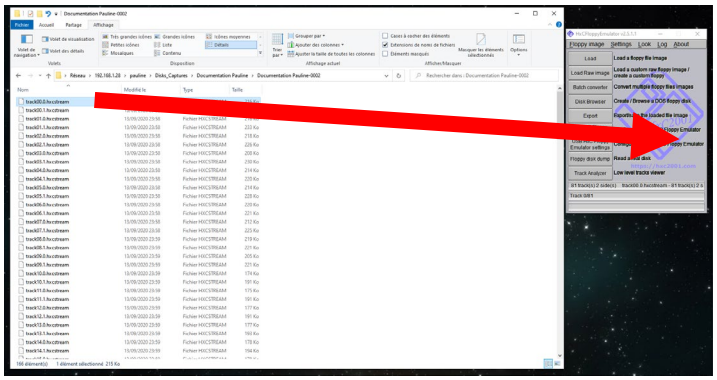
Green ... all is well ...

In the folder \pauline\Disks_Captures

A folder has been created corresponding to the name indicated in the « Name » section.

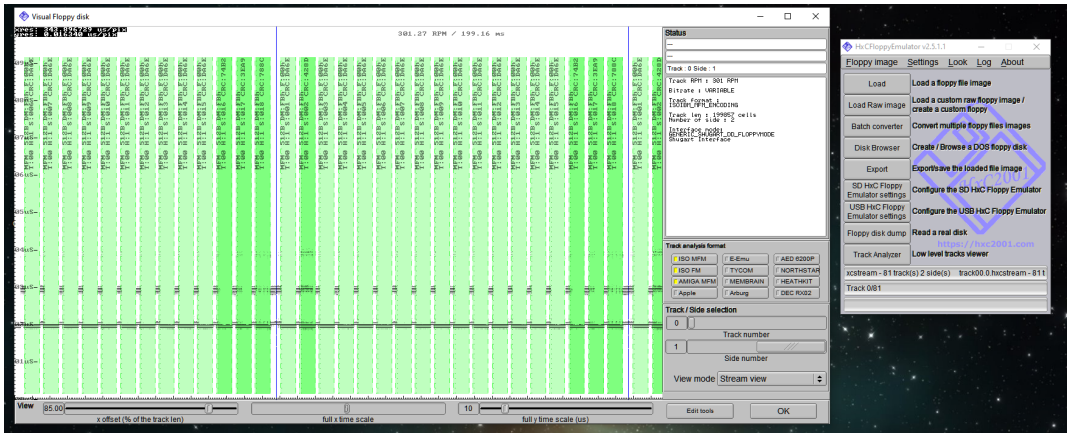
One file per track and per head (side) has been created in this folder
Example : track00.0.hxcstream = track 0 side 0 / track00.1.hxcstream = track 0 side 1

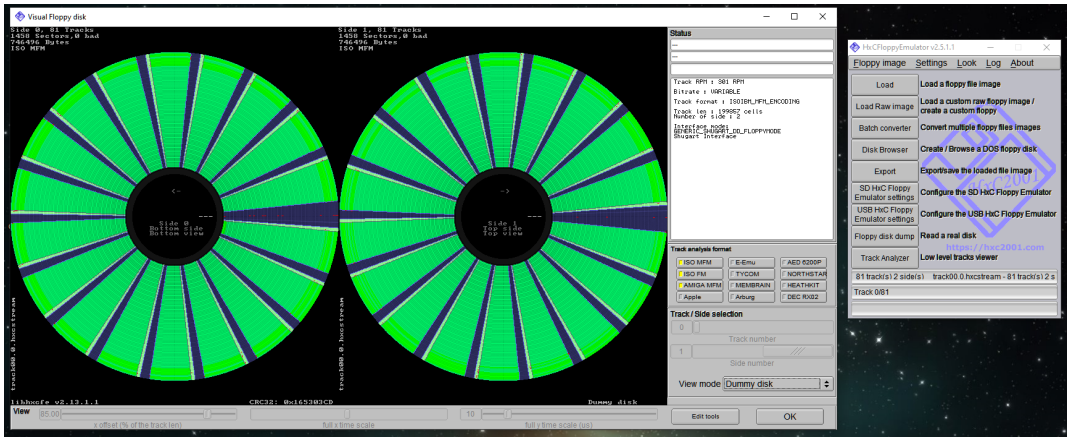
By drag and drop the first file on the HxCFloppyEmulator.exe application, an analysis of the files starts, after a few seconds or more depending on the amount of tracks read and the power of your computer.



YOUR FIRST "DUMP" UNDER HXCFLOPPYEMULATOR

By clicking on « Track Analyzer » button, the result appears.





About us

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https://hxc2001.com
https://sourceforge.net/projects/hxcfloppyemu/

Information about the associations

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https://www.laludotheque.fr
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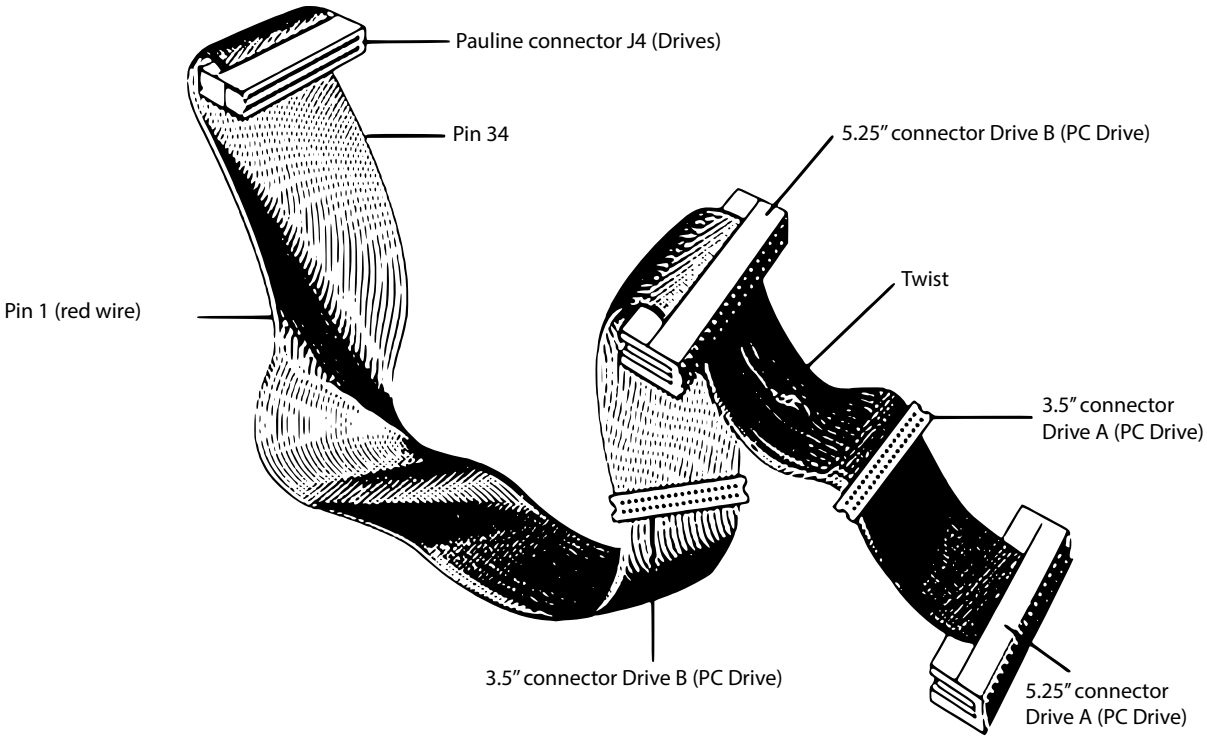
MO5.COM
https://www.mo5.com/site
Discord : https://discord.gg/phG9zNk

Game Preservation Society
8-19-1-C Todoroki Setagaya-ku
Tokyo 158-0082, Japon
https://www.gamepres.org/fr

Appendices

ASSIGNMENT OF CONNECTORS ACCORDING TO THEIR POSITION ON THE RIBBON CABLE



Sources

https://old.pinouts.ru/HD/InternalDisk_pinout.shtml

http://www.nullmodem.com/Floppy.htm

2ND TEST

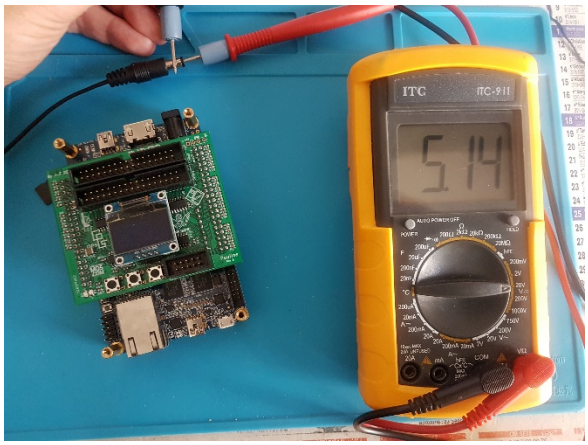
If everything is Ok, during the first test, you can check one last point :

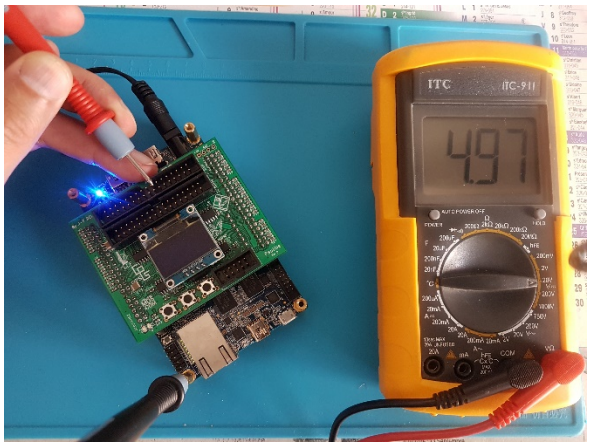
Turn off the power, remove the sdcard from the DE10 motherboard, and turn on Pauline.

All IOs of floppy ports must be in high state.

Otherwise there is a defect with a pull-down. It is important to check this to avoid false writings and other undesirable tricks during the first 200ms after powering up the card (fpga initialization time).

To do this, equip yourself with a multimeter (VOM), check the output voltage of your power supply then test the presence of 5V on the pins of ports J3 (host) and J4 (drives).





The voltage measured at the ports must be more or less the same as the power supply voltage (+/- 0.3V).

Everything is OK, let's go to the next step ...