

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	



**D4.7 User Manual
Version 2.1
September 14, 2023**

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

Version History

Version	Date	Description	Author
0.1	September 10, 2020	First Draft	Alexandre Corizzi
0.2	September 16, 2020	Feedback from Clémence Goyens	Alexandre Corizzi
0.3	September 22, 2020	Notes from Clémence Goyens	Alexandre Corizzi
0.4	September 24, 2020	Comments from Javier Concha	Alexandre Corizzi
0.5	September 29, 2020	Draft Notebook Tests Section	Clémence Goyens
0.5b	October 1, 2020	Pan/Tilt RS485 Config + FTP Link Correction	Alexandre Corizzi
0.5c	October 1, 2020	Feedback from Joel Kuusk	Alexandre Corizzi
1.0a	March 29, 2021	Update with new software	Alexandre Corizzi
1.0b	May 27, 2021	Timezone and other minor changes	Alexandre Corizzi
1.0c	June 9, 2021	Add Yoctopuce annex	Alexandre Corizzi
1.1a	July 15, 2021	Switch to Beta Version & Yoctopuce Update	Alexandre Corizzi
1.1b	July 16, 2021	Comments by David Doxaran	Alexandre Corizzi
1.1c	July 28, 2021	Comments by Joel Kuusk	Alexandre Corizzi
2.0	February 21, 2023	Add Mounting Illustrations & Debian	Alexandre Corizzi
2.1	April 21, 2023	Update GUI screenshots, metadata configs	Alexandre Corizzi
2.2	July 17, 2023	Update Debian section	Alexandre Corizzi

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

Contents

1 Executive summary	4
2 Mounting Guide	5
2.1 Material List	5
2.2 Flip the metal piece on the top of the instrument	8
2.3 The Inside of the Studiel Box	10
2.3.1 Yocto-Pictor - Dissasembling & Light Sensor	10
2.3.2 Yocto-Pictor - Reassembling in the Box	11
2.3.3 Rugged PC and Serial Board Converter fixing	12
2.4 Finalization	14
3 Installing a Linux Distibution	16
3.1 Debian Linux System	16
3.1.1 Creating an Installation USB of Debian Linux	16
3.1.2 Indicative settings for the Installation	16
4 Hypernets Tools	18
4.1 Presentation	18
4.2 Installation	18
4.3 Configuration Files	19
4.4 Common Examples of Command	19
4.4.1 Driving the Yocto-Pictor	19
4.4.2 Moving the Pan-Tilt	20
4.5 Protocol Files	20
4.5.1 Geometry	21
4.5.2 Measurements	21
4.5.3 Examples	21
5 First tests	22
5.1 Prior Set-up of the System and First tests	22
5.2 Validation Module Testing	22
6 Autonomous System Mode	24
6.1 Set Relay n°1 ON at Wake-up	24
6.1.1 Enable SSH access	24
6.2 Try a full sequence acquisition	25
6.3 Setup Server Communication	25
7 Annexes	26
7.1 Configuration file: static_config.ini	26
7.1.1 Section: yoctopuce	26
7.1.2 Section: network	26
7.2 Configuration file : dynamic_config.ini	26

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

7.2.1	Section: general	26
7.2.2	Section: GPS	26
7.2.3	Section: pantilt	27
7.2.4	Section: metadata	27
7.2.5	Section: hypstar	28
7.3	How To Access to the BIOS of the Cincoze	29
7.3.1	Pan-Tilt: Serial Port Configuration	29
7.4	Yoctopuce Tips	30
7.4.1	Upgrade Yocto-Pictor firmwares	30
7.4.2	How to catch debug informations	30
8	Old Versions Documentation	32
8.1	Manjaro Linux System	32
8.1.1	Creating A Live USB Of Manjaro Linux	32
8.1.2	Install and Update Manjaro Linux	33
8.2	Wi-Fi Connection Between the Yocto-Pictor and the rugged PC	34
8.2.1	Wi-Fi Hotspot Set-up	34
8.2.2	Setting up the Yoctopuce VirtualHub	35
8.2.3	Yocto-Pictor Wi-Fi Connection	36
8.3	Linking Hypernets Tools to the Yocto-Pictor	37
8.3.1	Radiometer Configuration and First tests with the GUI	38

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

1 Executive summary

This document aims to guide step by step the user to perform the installation of a Hypernets System. Firstly, a basic illustrated guide to assemble the different mechanical and electronic parts of the system will take place. Secondly, a tutorial about the installation of the a Linux operating system will be described. This, including both Manjaro and Debian Linux on the embedded computer (rugged PC). In third place, the basic set-up and some essential tests to move the pan-tilt - motor part of the system - and making some Hypstar Radiometer measurements will be provided. Finally, a procedure to make automatic measurements at arbitrary times - the autonomous mode - will be described.

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

2 Mounting Guide

2.1 Material List

Provider	Designation	
Tartu	Pan-tilt, Instrument & Validation Module	Right part of the Figure 1
	RS485 Serial Board Converter	Green Card in the Figure 1
	Alignment Tool	Figure 18
	Anti-Dust Cap	Figure 19
	Mechanical Part	Metal parts in the Figure 1
Studiel	Main Box	Figure 3
	Ancillary Box	Figure 4
	Junction Box	Figure 5
	1 Green Samtec Cable (Main box – Junction box)	Figure 2
	1 Orange Samtec Cable (Main box – Ancillary box)	Figure 2
	2 Yellow Samtec Cables (Webcams)	
	1 Blue Samtec Cable (Power System – Main box)	Figure 2
	2 Ray tech Rapid Joint	
	Yoctopuce Yocto-Pictor	Figure 9
N/A	Rugged PC Cincoze	Left part of the Figure 1
	Power system	
	2 Webcams Wi-Fi TVIP ABUS 62561	

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023



Figure 1: Yoctopuce, Rugged PC and Hypstar & Validation Module



Figure 2: Studiel Cables

Please note that the mechanical mount for pan-tilt and the powering system are not supported by this guide.

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023



Figure 3: The Studiel main Box



Figure 4: The Studiel Ancillary Box



Figure 5: Studiel Junction Box

2.2 Flip the metal piece on the top of the instrument

 **Required time:** 10 min

For shipping reasons – size of the package, avoiding shipping damages – the Hypstar Radiometer & the Validation Module are shipped with the top metal wing mounted in the wrong way. First, fix the pan-tilt on your mechanical mount. Unscrew the 4 screws (labelled in red on 6) and invert the direction of the wing like showed in the following pictures.

Material List:

- Allen key

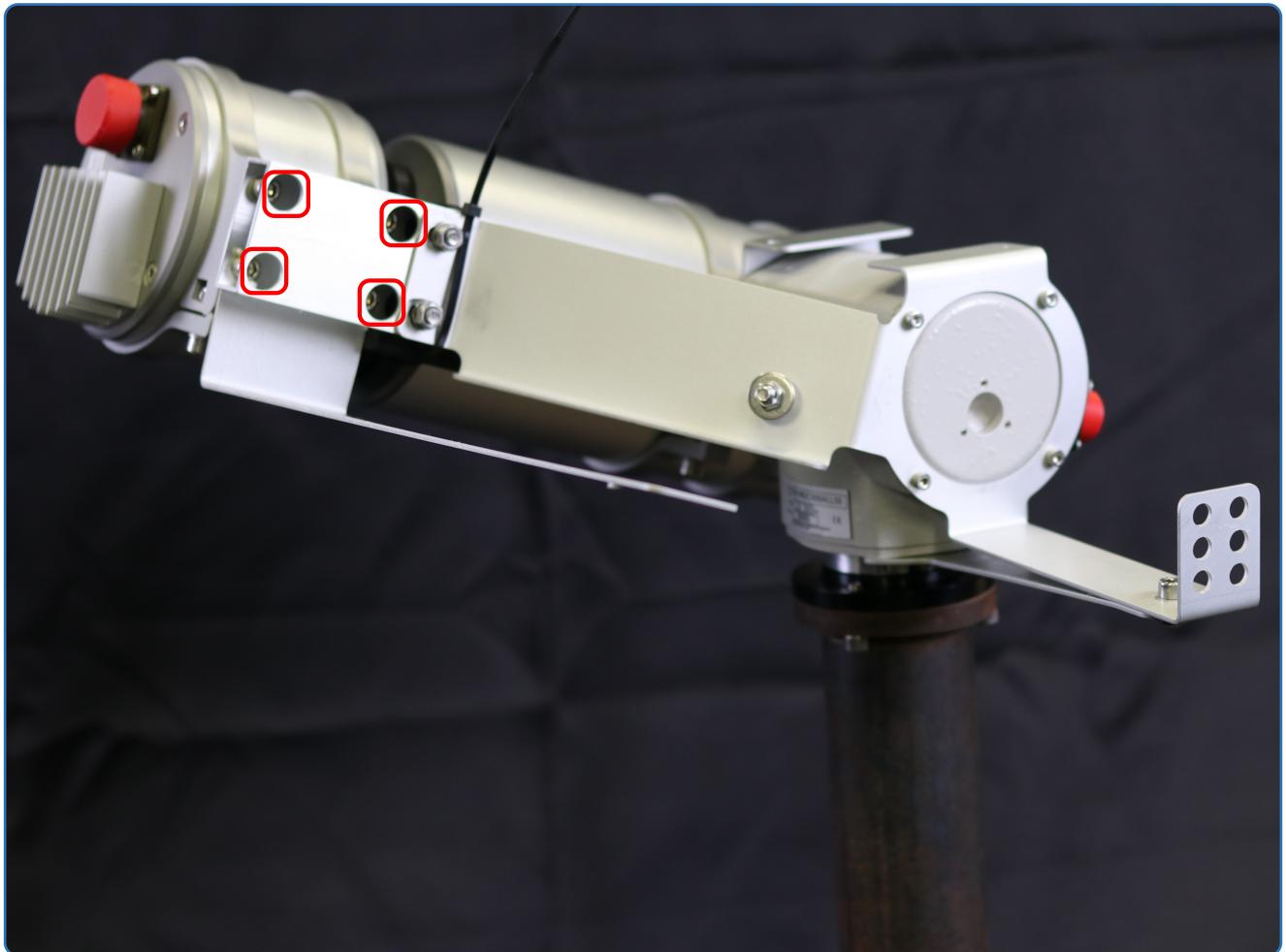


Figure 6: Flip metal piece 1/3

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023



Figure 7: Flip metal piece 2/3

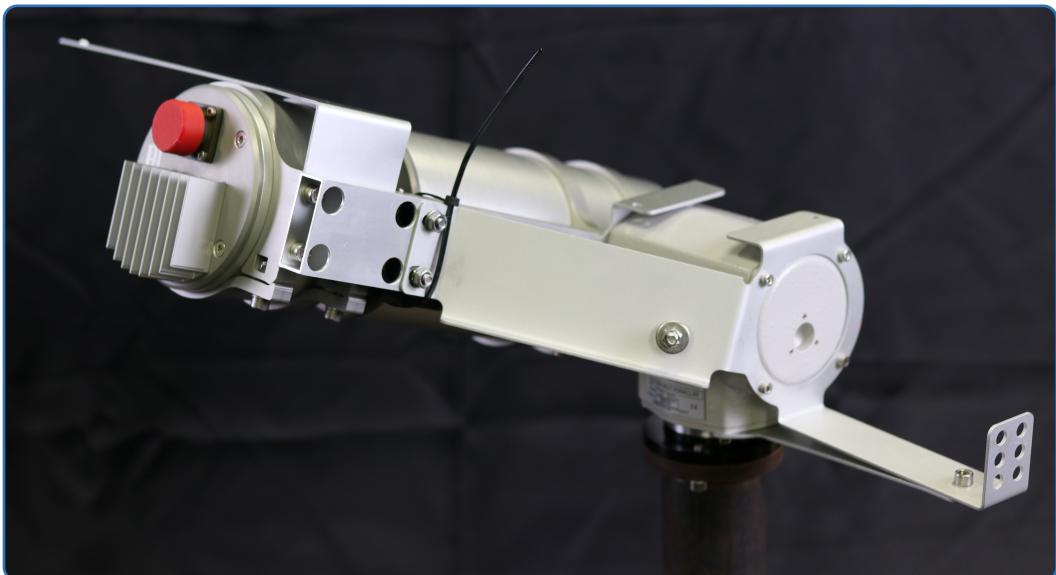


Figure 8: Flip metal piece 3/3

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

2.3 The Inside of the Studiel Box

 Required time: 30 min

Material List:

- Allen key 2 and 5, Plate key 7
- Screw drivers (flat/slotted and cross slot)
- Cutting plier

2.3.1 Yocto-Pictor - Dissasembling & Light Sensor

Instructions:

1. Unscrew the four screws at the top of the Yocto-Pictor
2. Split the Yoctopuce in two pieces (see figure 9)
3. Cut the light sensor of the ground floor
4. Fix it and plug it in the Studiel ancillary box (see figure 10)

Warning: make sure to correctly cut the PCB track of the light sensor before pulling it; there is a risk of ripping it off.

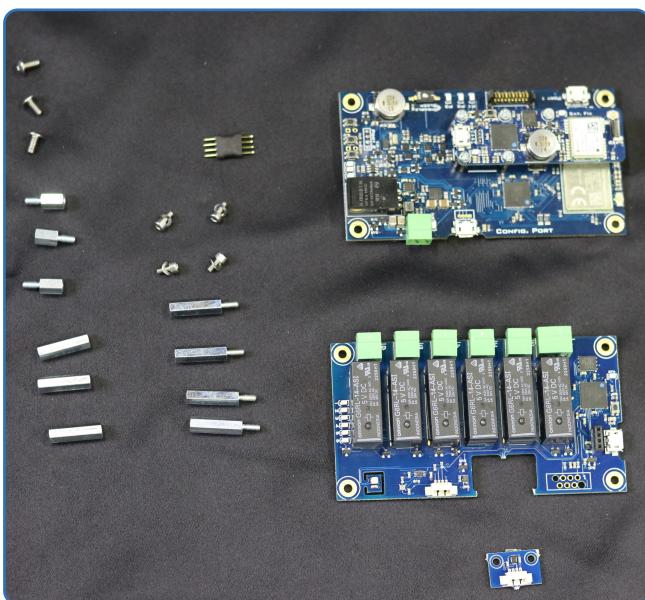


Figure 9: Dissasembling the Yocto-Pictor



Figure 10: Placement of the Light Sensor

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

2.3.2 Yocto-Pictor - Reassembling in the Box

Instructions:

1. Place the Yocto-Pictor ground floor with relays on the top and the 4 screw tubes (figure 11)
2. Plug the bottom-top bridge and add carefully the top floor and fix it with screws (figure 12)
3. Fix and connect the GPS antenna; then follow the wiring Table 1

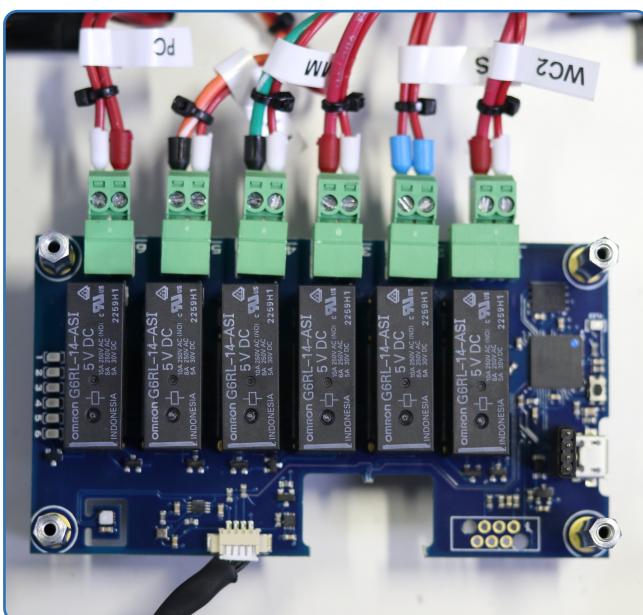


Figure 11: Fixing the bottom part

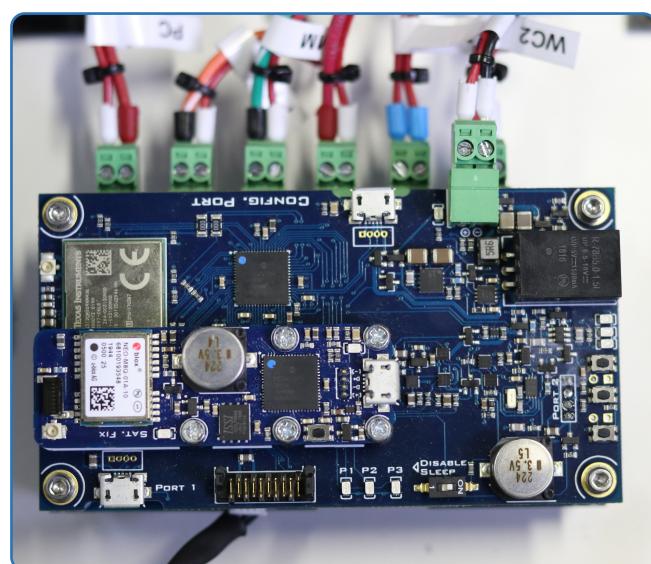


Figure 12: Fixing the top part

Yocto-Pictor Pinouts	Studiel Box Connectors
Relay 1	PC (Rugged PC power)
Relay 2	PT (Pan tilt)
Relay 3	MM (Measurement Module)
Relay 4	RS (Rain Sensor)
Relay 5	WC1 (Webcam 1)
Relay 6	WC2 (Webcam 2)
Main Power	YP (Studiel Box Connector)
Light Sensor Connector	Dedicated tablecloth USB
USB config Port	USB-B Micro cable

Table 1: Wiring table for the Yocto-Pictor

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

2.3.3 Rugged PC and Serial Board Converter fixing

Instructions:

1. Attach the fixation support provided with the rugged PC, the grids upwards (see Figure 13)
2. Unscrew the four screws (shown on Figure 14)
3. Fix the rugged PC ; the side with DIO and the four serial ports must be toward the top of the Studiel Box
4. Attach the serial board Converter and plug the brown cable in the slot A, the red cable in the slot B (Figure 16)



Figure 13: Rugged PC - Fixation System

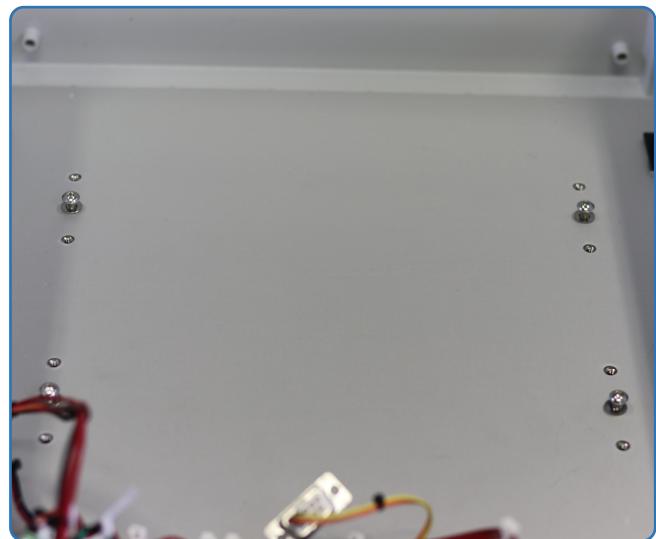


Figure 14: Area for the Rugged PC in the Box

Now, you should have connectors pending next to their rugged PC pinouts that you can plug:

- Connect the two DIO terminal (uneven numbers on top)
- Connect the RS485 wire (the one of the top) to the COM1
- Connect the power supply and the Ethernet connector
- Connect the USB cable for RS485 converter (HYPSTAR – Rugged PC connection)
- Connect the USB cable for Yocto-Pictor

Unscrew the top of the Junction Box and fix it on the top of the pan-tilt using the provided screws (see Figure 17).

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

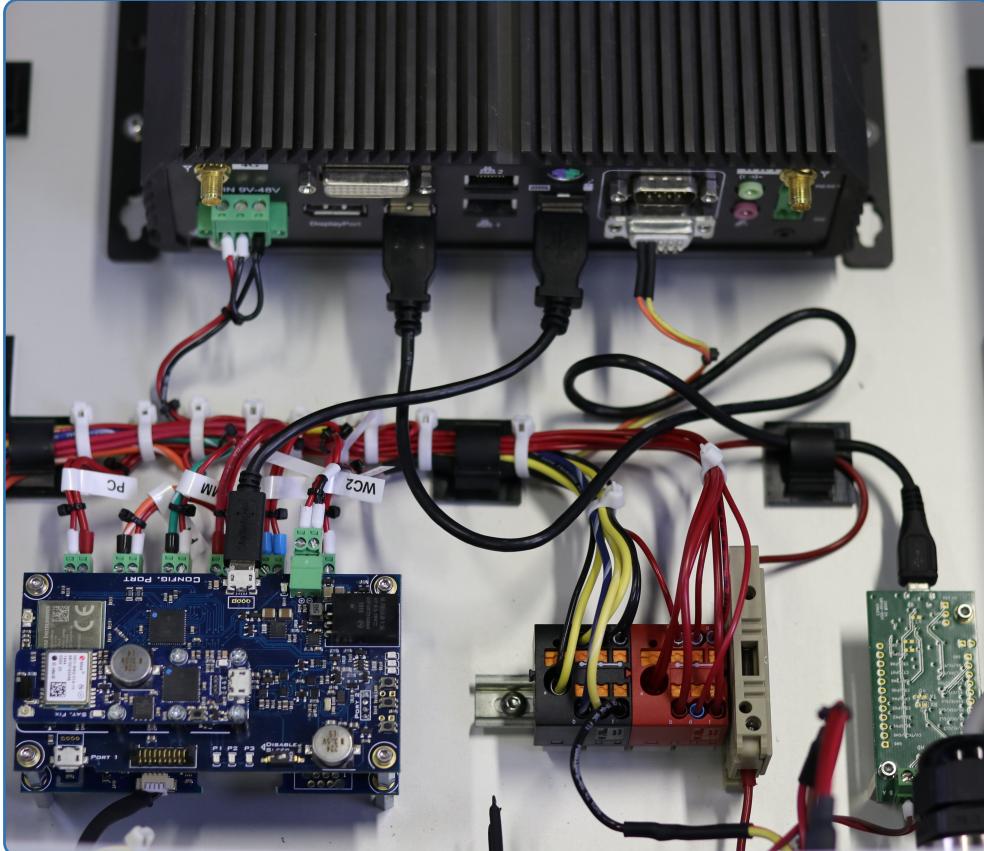


Figure 15: Global view of the inside



Figure 16: Serial Board Converter

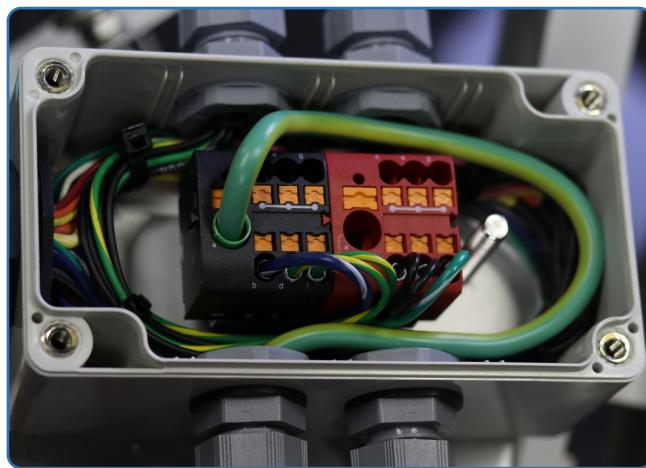


Figure 17: Fixing the Junction Box

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

2.4 Finalization

Instructions:

1. Carefully remove the Alignment Tool (Figure 18)
2. Place the anti-dust device (Figure 19)
3. Carefully respecting the color code, connect the cables
4. Make sure the rugged PC switch is on *AT*
5. Close the box

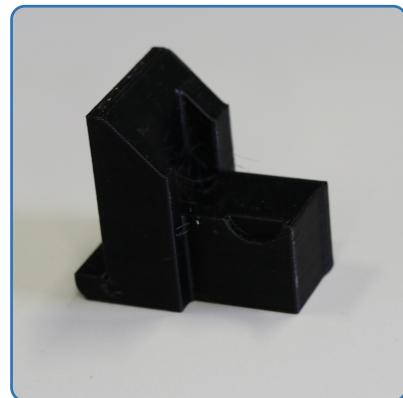


Figure 18: Remove the *Alignment Tool*

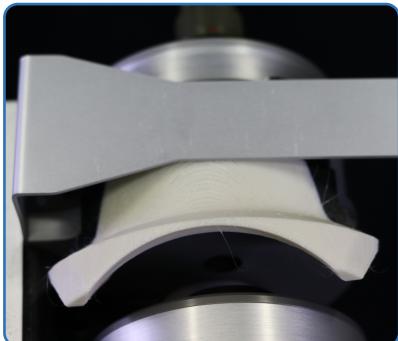


Figure 19: Put the anti-dust cap

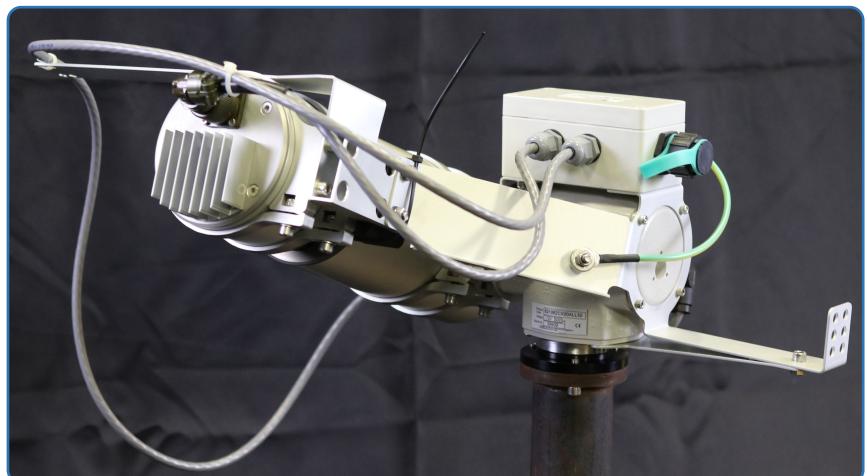


Figure 20: Fixing the cables

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

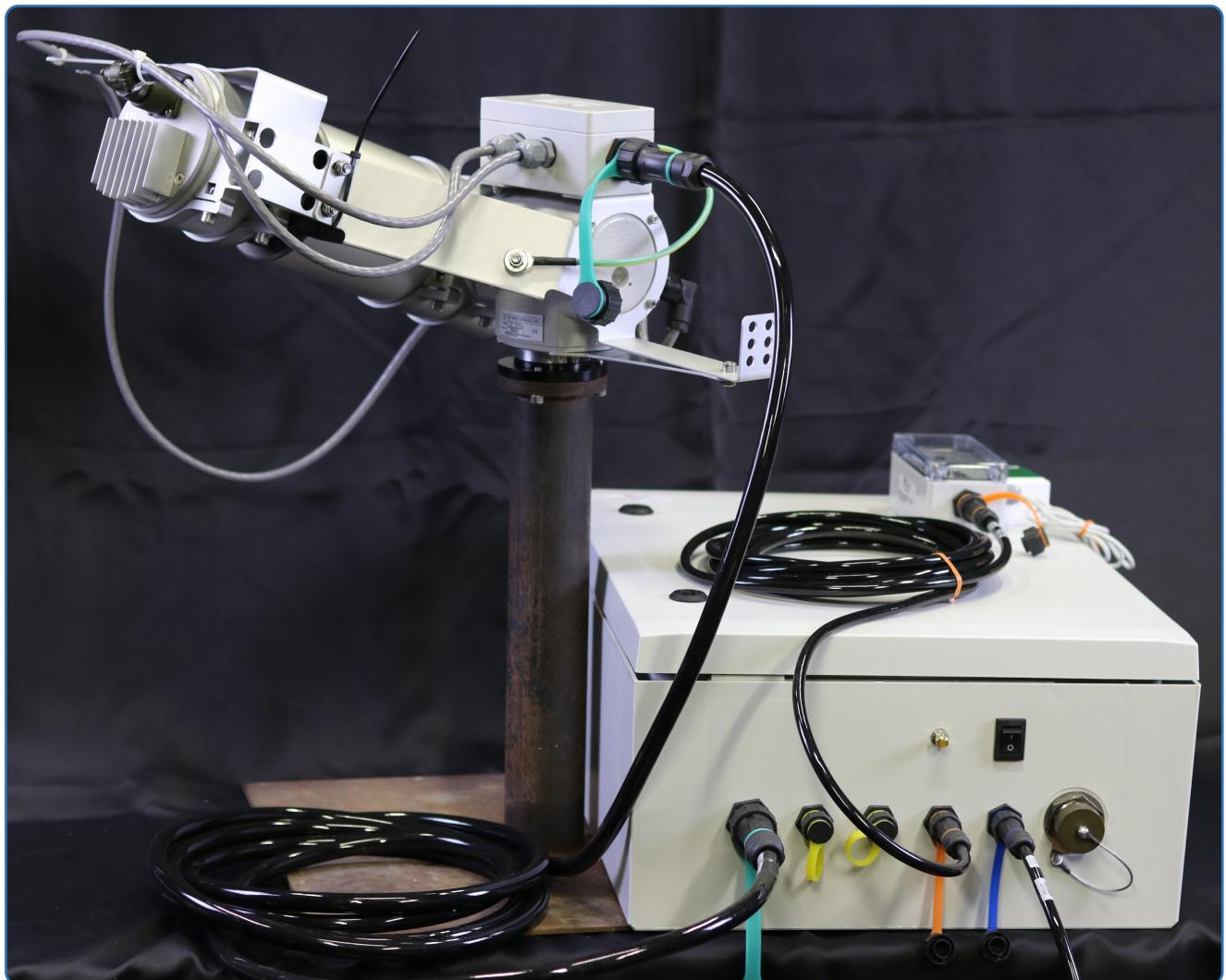


Figure 21: Overall Installation

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

3 Installing a Linux Distribution

⌚ Required time: 1 h 30

This part aims to install a fresh linux system on the rugged PC. Most of the first tests have been performed with *Manjaro* Linux. However, any UNIX system could replace this distribution. We also have experimented few updating issue with Manjaro as it is a *rolling release distribution*. Hence the last version of the software has been tested with *Debian* that might be the prefered solution.

Material List:

1. Rugged PC Cincoze
2. USB Stick up to 2GB
3. Internet connection
4. Screen, keyboard, and mouse

3.1 Debian Linux System

3.1.1 Creating an Installation USB of Debian Linux

Alternatively you can use a Debian System, visit this [link](#) and download those two files:

```
debian-11.7.0-amd64-netinst.iso
SHA256SUMS
```

Check-up the integrity of your downloaded file with:

```
sha512sum -c SHA512SUMS.txt
debian-11.7.0-amd64-netinst.iso: Success
```

The next step is to burn the image with:

```
umount /dev/sdX*
sudo dd if=/path/to/debian.iso of=/dev/sdX status="progress"
(replace sdX with the ID of your usb stick)
```

Double check your device name before writing onto it (please refer to the equivalent 8.1.1 in the Manjaro section).

3.1.2 Indicative settings for the Installation

1. Boot on the USB stick (see Annex 7.3 to configure the BIOS)
2. Choose the *Graphical Install* and the language *English*
3. Set *United Kingdom* as location and select your keyboard mapping

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

4. Configure a Network connection for the installation
5. Set up machine name, user and root passwords
6. Force UEFI installation: *yes*
7. Select the *guided partitioning* with all files in one partition (recommended)
8. Participate in the package usage survey: *no*
9. **Select the Xfce server X** and add *standard system utilities*

Once done, remove the USB key stick and reboot. You should see a prompt asking you the password you previously setted-up. Open a terminal (*ctrl + alt + t*) and type the following commands:

```
rmdir Music/ Pictures/ Videos/ Public/ Templates/
su
<password>
/usr/sbin/usermod -aG sudo <username>
/usr/sbin/usermod -aG adm <username>
```

Logout, login and install git with:

```
sudo apt install git
```



Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

4 Hypernets Tools

4.1 Presentation

hypernets_tools is the software developed for the Hypernets System. It consists in a *Git* repository, it is mainly developed with Bash and Python (3.7+) languages. It is fully compatible with any UNIX system which includes *apt* or *pacman* and a functionnal *systemd* installation. It is also dependent on the *libhypstar*, the *driver* library of the Hypstar. *hypernets_tools* is designed in the form of a python package, containing several folders, grouped by thematic. Most of the scripts contained within those folders are *callable* from a terminal and are *self explanatory* thanks to the *help* command. In addition, a *Graphical User Interface* is built on top of those scripts, allowing to use some basic functionnalities of the system.

The installation of the *hypernets_tools* is made using the *distributed version control system Git*. If you aren't familiar with this tool, you can refer to the [the wikipedia of Git](#) or its documentation.

4.2 Installation

First clone the repository of the project with:

```
git clone https://github.com/hypernets/hypernets_tools
```

Check-out the appropriate branch with:

```
cd hypernets_tools/
git branch -r          # List all remote branches
git checkout main       # Checkout the branch you want
```

You should now be able to use the installation wizard:

```
sudo ./install/EE_wizard.sh
```

This wizard will prompt you a menu where you can:

1. Update hypernets_tools
2. Install Dependencies
3. Download and install YoctoHub
4. Run Yocto-Pictor auto-config
5. install / update libhypstar
6. Configure Hypstar port

Once every step is done, you can try to launch the *Graphical User Interface* (and refer to the section 5 for the first tests) with:

```
python -m hypernets.gui
```

4.3 Configuration Files

All parameters of the *hypernets_tools* can be found in text files called *configuration files*. Splitted in two different parts, the first one is called *static* (see annex 7.1) ; and the second one *dynamic* that will be synchronized over network allowing the user to perform remote setting-up of the system (see annex 7.2). You can edit it using any text editor (e.g. vi, nano, ...).

```
ls
config_static.ini config_dynamic.ini
```

4.4 Common Examples of Command

As a python application, you can *call* most of the modules and submodules of *hypernets_tools* using the *python -m hypernets.module.submodule* syntax. Moreover, the command ”*-help*” with a package name can provide informations about how to use the package on the *Command Line Interface*. Note also that arguments are following the GNU argument syntax convention :

https://www.gnu.org/software/libc/manual/html_node/Argument-Syntax.html

4.4.1 Driving the Yocto-Pictor

```
python -m hypernets.yocto.relay --help
logs/yocto_relay_help.txt

usage: relay.py [-h] (-g | -s {on, off} | -r | -p {on, off, unchanged})
                 -n {1..6} [-f]

optional arguments:
  -h, --help            show this help message and exit
  -g, --get              display relay's states
  -s {on, off}, --set {on, off}
                        set the state of the relay
  -r, --reset           reset relay (1 sec off, then on)
  -p {on, off, unchanged}, --set-at-power-on {on, off, unchanged}
                        schedule the state of the relay for next wakeup
                        (use --force [-f] to write in flash memory)
  -n {1..6}, --id-relay {1..6}
                        ID number of the relay
  -f, --force           forces relay #1 to switch off, and allows to
                        write in memory for the state at power-on option
```

Closing the relay number one:

```
python -m hypernets.yocto.relay --state on --id-relay 1 # long version
python -m hypernets.yocto.relay -son -n1 # short version
```



Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

4.4.2 Moving the Pan-Tilt

```
python -m hypernets.geometry.pan_tilt --help
```

```
logs/pan_tilt_help.txt
```

```
usage: pan_tilt.py [-h] -p {0..360} -t {0..360} [-w] [-v]
```

optional arguments:

-h, --help	show this help message and exit
-p {0..360}, --pan {0..360}	set pan (azimuth angle in degrees)
-t {0..360}, --tilt {0..360}	set tilt (zenith angle in degrees)
-w, --wait	wait for pan/tilt end of move and return real position
-v, --verbose	print extra information

```
python -m hypernets.geometry.pan_tilt --pan 90 --tilt 180 --wait # long
python -m hypernets.geometry.pan_tilt -w -p 90 -t 180           # short
```

4.5 Protocol Files

In order to process an automatic sequence file (i.e. a multitude of measurement from diverse geometry), you have to first define a *sequence file*. A bunch of example of sequence file are given in the hypernets/ressource/sequence_sample folder. Edit then the field *sequence_file* under the general section of *config_dynamic.ini*. Note that the path to your sequence file can be absolute or relative path (see Annex 7.2). Prior to any other instruction, the file has to start with this line:

```
HypernetsProtocol v2.0
```

The general syntax to make a measurement can be given as a *one line instruction*:

```
@[geometry1, #flag1, #flag2] + I.measurement1 + J.measurement2
```

or like this:

```
@[geometry2]
  + K.measurement3
  + L.measurement4
```

Whith *geometry1* and *geometry2* for two geometries; *I*, *J*, *K*, *L* are the counts (integers, number of measurement) associated respectively with *measurement1*, *measurement2*, *measurement3* and *measurement4*; and *flag1* and *flag2* are two associated conditions for the geometry1.



Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

4.5.1 Geometry

A geometry always starts with the symbol "@" and contains a *pan* (azimuth) coordinate follow by a pan reference, and a *tilt* (zenith) coordinate follow by a tilt reference. Optionally, one or several flags (conditionning flag) can be specified in a geometry.

3 types of geometry reference are understandable :

- *abs* : absolute (given as the pan-tilt reference)
- *sun* : sun azimuth and zenith as a reference
- *hyper*: north (pan) and nadir (tilt) as a reference

4.5.2 Measurements

Measurement can be of 3 different types:

- Radiometer: defined as a type (*vnir*, *swir*, *both*) and an entrance (*rad*, *irr*, *dark*), follow by two integration times concatenated by dots.
- Picture
- Validation

4.5.3 Examples

```
@[0, sun, 0, sun] + 1.picture          # Take a picture of the sun
@[0, hyper, 90, hyper]                  # Point to the horizon north
@[198, abs, hyper] + 20.validation    # Make 20 VM measurements
@[90, sun, 180, hyper] + 6.vnir.irr.0.0 # Make 6 irradiance measure
```

HypernetsProtocol v2.0

```
# Flag definitions :
~ #firstLessThanFourSec := $spectra_file1.it_vnir <= 4096
~ #sequenceWasFastEnough := $elapsed_time < 120

@[ 90.0, sun, 180.0, hyper ]
  + 1.vnir.irr.0.0
# Picture of the Sun only if sequence is < 2 minutes
@[ 0.0, sun, 0.0, sun, #firstLessThanFourSec ]
  + 1.picture
# Park only if first integration time is less than 4 second :
@[ 0.0, sun, 0.0, hyper, #sequenceWasFastEnough ]
```

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

5 First tests

⌚ Required time: 15 min

This section describes how to operate the functionalities of the Yocto-Pictor including relays functions, GPS, temperature, humidity, or light sensors values reading. The second part explains how to use the Yocto-Pictor to power the computer instead of a *classical* power supply unit. Finally, instrument pointing and Hypstar measurements thanks to the GUI will be described.

5.1 Prior Set-up of the System and First tests

If necessary, get the *hotspot connection* working back ([8.2.1](#)) and start the GUI:

```
python -m hypernets.gui
```

Follow those steps to take a spectrum:

- Click on *Connection* and activate the relay #2 (figure [22](#))
- Wait for 20 seconds (instrument boot time) and click on *acquisition*
- Click on *Show plot* to see the taken spectrum (figure [24](#))

Note: in order to display the real axis unit (in nanometre) and to calibrate the spectrum. First *dump* the *linearity and calibration coefficients*, from the radiometer. Let the relay #2 opened, exit the GUI and type once command:

```
python -m hypernets.dump_current_config
```

5.2 Validation Module Testing

- Open the GUI and activate relay #2, and #3 (Figure [22](#)).
- Wait for 20 seconds (instrument boot time)
- On the pan-tilt section: set-up the tilt to 198°, click on *move*
- Press on *Turn VM on*, and *Measure VM*
- Visually check if the Validation Module is lighting
- The spectrum graph of the measure should appears (Figure [24](#))

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
	Version	2.1
	Date	September 14, 2023

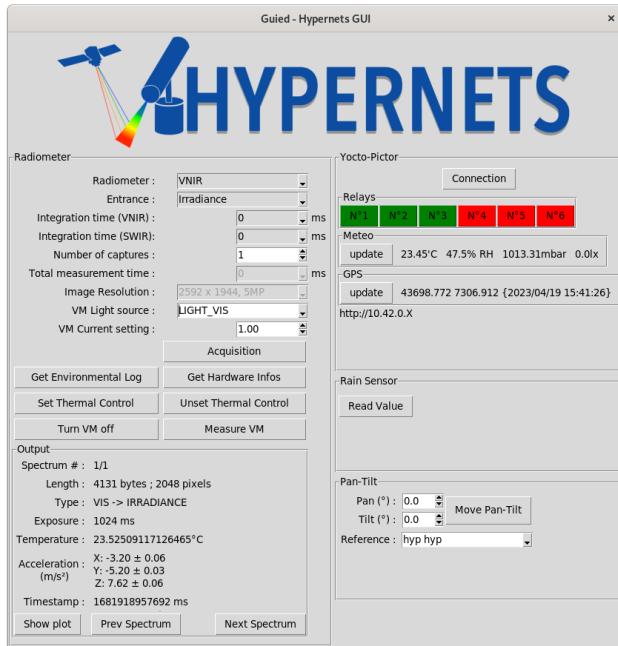


Figure 22: Graphical User Interface

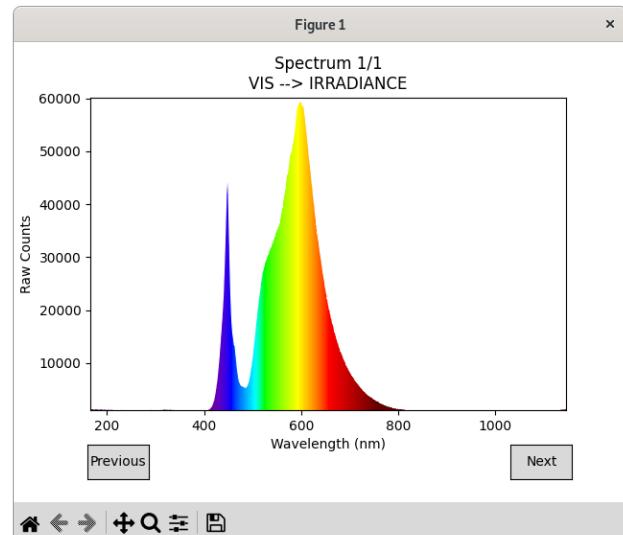


Figure 23: A Spectrum Plot

```
r2d2009@r2d2009:~/hypernetstools$ python -m hypernetstools.gui
[INFO] [2023-04-19T16:42:20] LibHypstar driver v0.3.1 (commit #5ec59d3)
[INFO] [2023-04-19T16:42:20] Creating serial port (baud=115200, portname=/dev/radiometer0)
[INFO] [2023-04-19T16:42:20] Got serial port
[ERROR] [2023-04-19T16:42:21] Spectrometer responded with error 0xE0 - bad crc
[ERROR] [2023-04-19T16:42:21] << CE 09 00 00 00 00 E0 25
[INFO] [2023-04-19T16:42:21] Instrument S/N: 122302, FW revision: 0.18.2, MCU revision: 5, PSU revision: 5,
VM S/N: 323054, VM FW: 0.1.1
1 spectra red.
```

Figure 24: Some Outputs on the console

6 Autonomous System Mode

6.1 Set Relay n°1 ON at Wake-up

Before using the studiel-box, we need to set the Yocto-Pictor first relay default value as ON. This aims to power-on the rugged-PC at the wake-up time of the Yocto-Pictor. To achieve this, fire up a terminal and use those commands:

```
cd hypernets_tools/
python -m hypernets.yocto.relay -fpon -n1
```

In order to test if it worked, hold the sleep button (the middle one) on the Yocto-Pictor until it goes to sleep. Then wake it up by pressing the wake-up button (the upper one on the figure 25). The relay 1 should be closed and the associated green LED (i.e. the LED 1 ; on the right of the card in the figure 25) should light.

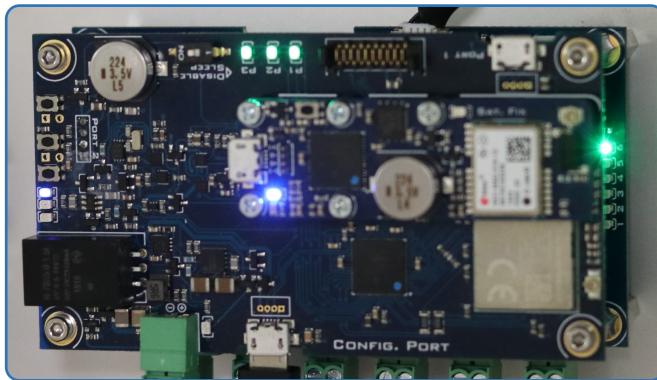


Figure 25: Yocto-Pictor: Three black buttons on the upper-left corner & Green Relay Light on the right side of the bottom card

6.1.1 Enable SSH access

Closing the Studiel-box will make our system *headless*. *i.e.* it won't have any keyboard, screen or mouse connected on it. As we still need to interact with it, a workaround solution is to connect to Wi-Fi and access it through a SSH, a *Secure Shell*. To enable this service, type those two lines in terminal:

```
sudo systemctl enable sshd      # For Manjaro
sudo systemctl start sshd
sudo systemctl enable ssh       # For Debian
sudo systemctl start ssh
```

Expected output:

```
Created symlink /etc/systemd/system/multi-user.target.wants [...]
```

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

Then, try to connect to the Wi-Fi with any laptop and SSH like this (you can use [Putty](#) on Windows):

```
ssh 'rugged_pc_user_name'@10.42.0.1
```

6.2 Try a full sequence acquisition

Now edit the *dynamic configuration* file and edit it with the following values:

- *sequence_file = path to the sequence of your choice*
- *start_sequence = yes*
- *keep_pc = on*

Then, run the command below and see if it works. The output *sequence directory* should be saved in the folder *DATA*. Its name is prefixed by *SEQ* and given according to the *current UTC date and time* with the following format: *SEQYYYYMMDDTHHMMSS*.

```
./utils/run_service.sh
```

If everything is working properly, you can refer to the yoctopuce [wake-up scheduler documentation](#) in order to configure the system to wake up autonomously. In addition, to enable the automatic run of the sequence every time the system wakes up, run the installation script:

```
sudo install/04_setup_script_at_boot.sh
```

6.3 Setup Server Communication

If not already done, generate a ssh key with:

```
ssh -t rsa
```

Edit the section *network* of the file *config_static.ini*, create an empty directory in the appropriate folder on the server and run:

```
sudo install/05_setup_server_communication.sh
```

Example: if your site name is

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

7 Annexes

7.1 Configuration file: static_config.ini

The *static configuration file* is the file dealing with the parameters that user will preferably not change. It includes the communication settings with the Yocto-Pictor and the server credentials. As it contains critical settings, this file will not be automatically synchronized over the network.

7.1.1 Section: yoctopuce

field	definition	values (default)
yoctopuce_ip	Yocto-Pictor-Wifi IP Address	10.42.0.X
yocto_prefix1	Yocto-Pictor Serial (relay board)	OBSVLFR1-XXXXXX
yocto_prefix2	Yocto-Pictor-Wifi Serial	OBSVLFR2-XXXXXX
yocto_gps	Yocto-GPS-V2 Serial	YGNSSMK2-XXXXXX
bypass_yocto	Bypass Yocto-Pictor during in a sequence (debug mode)	no

7.1.2 Section: network

field	definition	default
credentials	user account and server name	user@server
remote_dir	name of the remote directory where data/config/logs are pushed	~/XXYY
ssh_port	ssh port used to connect to the server	22
remote_ssh_port	ssh port used to connect from the server to the host system (use ssh -p 20213 rugged_pc_user@127.0.0.1 to connect)	20213

7.2 Configuration file : dynamic_config.ini

The *dynamic configuration file* is a communication tool allowing the user to remotely change settings of the system. Unlike the *static configuration file*, it is synchronized with an identical file on the server side. Synchronization over the network is performed using the one with the more recent modification.

7.2.1 Section: general

field	definition	values (default)
keep_pc	state of the system at the end of the sequence	on / off
start_sequence	start or no the sequence every time the system is turned on	yes / no
auto_update	check for update at start-up	yes / no
sequence_file	which protocol file to follow	<i>path to file</i>

7.2.2 Section: GPS

field	definition
latitude	Cartesian latitude of the location (float)
longitude	Cartesian longitude of the location (float)

7.2.3 Section: pantilt

field	definition	values (default)
offset_pan	Azimuth adjustement value (in degrees) to point to South or North	[0 - 360] 0
offset_tilt	Zenith adjustement value (in degrees) to point to point the Nadir	[0 - 360] 60
reverse_tilt	Change the sign of both Azimuth and Zenith	yes / no

7.2.4 Section: metadata

Metadata are the information embedded in each Hypernets Sequence folder. In particular, each metadata file will have a *header*, that is, the top of the file. This header contains some dynamic informations like the current date and time as well as static ones, for instance the site identification. This section of the *dynamic config file* is the exact content of each metadata header. Fields between brackets will be automatically processed by the host system.

field	definition	values
principal_investigator	Name of the PI,	<i>Investigator name</i>
datetime	UTC date and time at the sequence start time (no need to edit)	{datetime}
hypstar_sn	Hypstar Serial Number	123456
site_id	A site ID with the naming convention: XXYY such as: – XX: two first letters of the site name – YY two first letters of the country partners-name	XXYY
protocol_file_name	Self-reference to the <i>protocol file name</i> from the <i>general section</i> of this file (no need to edit)	\${general:sequence_file}
latitude	Self-reference to the latitude from the GPS section of this file (no need to edit)	\${GPS:latitude}
longitude	Self-reference to the longitude from the GPS section of this file (no need to edit)	\${GPS:longitude}
offset_pan	Self-reference to the <i>protocol file name</i> from the <i>pantilt</i> of this file (no need to edit)	\${pantilt:offset_pan}
offset_tilt	Self-reference to the <i>protocol file name</i> from the <i>pantilt</i> of this file (no need to edit)	\${pantilt:offset_tilt}
offset_tilt	Self-reference to the <i>protocol file name</i> from the <i>pantilt</i> of this file (no need to edit)	\${pantilt:offset_tilt}
azimuth_switch	Self-reference to the <i>protocol file name</i> from the <i>pantilt</i> of this file (no need to edit)	\${pantilt:azimuth_switch}

Note : if you want to see what your metadata header will look like, you can use this command :

```
python -m hypernets.abstract.create_metadata
```

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

7.2.5 Section: hypstar

field	definition	values (default)
hypstar_port	path to the hypstar <i>device file</i>	/dev/radiometer0 /dev/ttyUSB5
baudrate	speed communication (in bauds) with the instrument	115200, 460800, 921600, 3000000, 6000000, 8000000
loglevel	Set the log verbosity of the communication with the instrument	ERROR, INFO, DEBUG, TRACE
swir_tec	Thermoelectric Cooler setting point (in degree Celsius) the SWIR module	[-15 ; +40] 0

Log Level	Definition
ERROR	only errors are reported on stderr
INFO	stdout + stderr
DEBUG	driver command execution printout to stdout
TRACE	low level communication bytes are printed to stdout

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

7.3 How To Access to the BIOS of the Cincoze

You will need to access to the *Basic Input Output System* menu (or BIOS CMOS Setup Utility) to perform some configuration tasks like set-up the serial port or boot from USB stick. To get this access, turn *OFF* and *ON* the computer, then immediately press **** or **<ESC>**. You should see a screen similar to the figure 26. If not, you may refer to the [User's Manual of the computer](#).



Figure 26: Screenshot of BIOS

7.3.1 Pan-Tilt: Serial Port Configuration

Go to the BIOS (see annex 7.3). Under the tab *Advanced* go to the menu *Super IO Configuration*, select the serial port for the pan-tilt (usually the n°4) and select *RS485 Half Duplex* on the line *Onboard Serial Port 4 Mode*. Save and exit.

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

7.4 Yoctopuce Tips

7.4.1 Upgrade Yocto-Pictor firmwares

Please refer to the [yoctopuce documentation](#) in order to upgrade the firmwares.

7.4.2 How to catch debug informations

The Yocto-Pictor is still a tool under development and some bugs may sometimes show up. So when something wrong happens. For example the software is reporting an error relative to yocto or the behaviour is not the one expected. It could be helpful to join a *memory dump* of the card to the issue report. In order to get this file, here is the most common scenario:

1. Something goes wrong with the card.
2. Don't touch anything but hold on the Ybutton during 5 seconds (see figure [27](#)).
3. Now, restart the system in order to get back the Wi-Fi connection working.
4. Go to the yoctopuce webpage (by typing : 10.42.0.X:4444 in the address bar of a web browser).
5. Click successively on *Configure* (on the row of *Yocto-Pictor-Wifi*), then *manage files* (see [28](#)).
6. You should see a row with *dump.bin* under the column *Path/name*. Download this file, using *right click* and *Download Linked File*. (see [29](#)).
7. Finally click on *remove* to delete the file in order to avoid eventual future confusion.

For convenience, you can name the file with your initials, the date and an error reference if there is one. Also, please mind to always send this file with an explanation of the issue or the error logs.

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	



Figure 27: Highlighted *YButton*

OBSVLFR2-13FB00

Edit parameters for device OBSVLFR2-13FB00, and click on the **Save** button.

Serial #	OBSVLFR2-13FB00
Product name:	Yocto-Pictor-Wifi
Firmware:	44330
Logical name:	<input type="text"/>
Luminosity:	 (signal leds only)

Device functions

Each function of the device has a physical name and a logical name. You can change the logical name using the **rename** button.

OBSVLFR2-13FB00.dualPower /	rename
OBSVLFR2-13FB00.files /	rename
User files: 1 file, 3276 KB available	manage files
OBSVLFR2-13FB00.hubPort1 /	rename

Figure 28: Hightlighted *file manager*

IK2-13F53E Yocto-GPS-V2 File manager

Files currently loaded into device:

Path/name	Size	CRC	Action
dump.bin	2720	5BFDC47B	remove

Open Link in New Tab
Open Link in New Window
Download Linked File
Copy Link Location
Inspect Element

Figure 29: Download *dump.bin*



Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023

8 Old Versions Documentation

8.1 Manjaro Linux System

8.1.1 Creating A Live USB Of Manjaro Linux

First, please go to [manjaro archive download page](#) and download the "minimal" version ISO of Manjaro linux 21.0. Then, make the ISO file Bootable on USB drive. Under Windows, you can do it by using [easy2boot](#) for example. Under Linux and Mac, you can use the following instructions.

Open a terminal, type the following command:

```
sudo dmesg -w
```

Now connect your USB stick memory, you should get output similar to this:

```
1 [10576.130389] usb-storage 2-6:1.0: USB Mass Storage device detected
2 [10576.130756] scsi host5: usb-storage 2-6:1.0
3 [10577.144722] scsi 5:0:0:0: Direct-Access      SanDisk Ultra USB 3.0
4 1.00 PQ: 0 ANSI: 6
5 [10577.145229] sd 5:0:0:0: Attached scsi generic sg6 type 0
6 [10577.145493] sd 5:0:0:0: [sdf] 30031872 512-byte logical blocks:
7 (15.4 GB/14.3 GiB)
8 [10577.146230] sd 5:0:0:0: [sdf] Write Protect is off
9 [10577.146233] sd 5:0:0:0: [sdf] Mode Sense: 43 00 00 00
10 [10577.146485] sd 5:0:0:0: [sdf] Write cache: disabled, read cache:
11 enabled, doesn't support DPO or FUA
12 [10577.153805] sdf: sdf1
13 [10577.155586] sd 5:0:0:0: [sdf] Attached SCSI removable disk
```

Here, the linux device naming for the USB key is `/dev/sdf` (line 12). Next step is to *umount* all file systems of this USB key from the file hierarchy in order to prevent any access by other application. Then we need to format the unmounted drive in Linux journaling file system *ext4*. And finally copy the Manjaro Linux ISO file to the USB drive. Adapt the following commands with the name of your device and the path to the ISO file you just downloaded. Note the ending star for the first command.

Warning: it is critically important not to copy the ISO onto the wrong device! Please double check before going ahead with the next.

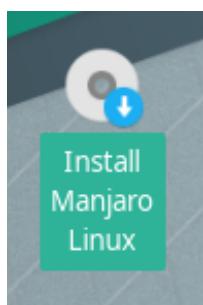
```
umount /dev/sdf*
sudo dd if=/path/to/manjaro.iso of=/dev/sdf status="progress"
```

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

If ISO is properly copied to bootable USB, you should see the new name MJRO1815 for the USB key.

8.1.2 Install and Update Manjaro Linux

Insert the Live USB flash drive into the computer, power it, and get access to the BIOS (see annex [7.3](#)). Go under the tab named *Boot* and press enter on the menu *Hard Drive BBS Priorities*. You should see the name of your hard-drive on the first row and the name of your usb drive on the second one. If you don't see your USB key in here this may mean your bootable USB key is not made properly. Use <+/-> controls to put your flash drive on the first, then press <**Esc**> to quit the menu, go under *Save & Exit* and select *Save Changes and Reset*.



Once Manjaro has started, double-click on the icon *Install Manjaro Linux* (lower left corner)

- Use American English (US)
- Choose Europe as Region and London as Zone
- Choose ERASE DISK
- Login and password (use same for administrator)

Then reboot again without the USB stick. After getting your desktop environment started, set up an Internet connection, open a terminal (press <**ctrl + alt + t**>) and type the following commands in the terminal in order to clean your *home directory* update the system and install *git*:

```
rmkdir Music/ Pictures/ Videos/ Public/ Templates/
sudo pacman -Syu
sudo pacman -S git
sudo pacman -S git
```

Say yes/or default [ENTER] to all questions. Note that once done, the computer may reboot.

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

8.2 Wi-Fi Connection Between the Yocto-Pictor and the rugged PC

 **Required time:** 10 min

The Yocto-Pictor, provided as the electronic card of Hypernets system is controlled through Wi-Fi by the rugged PC. The three following subsections describe how to set-up this communication.

8.2.1 Wi-Fi Hotspot Set-up

This part aims to configure the Wi-Fi of the rugged PC. It will mainly be used to control the Yocto-Pictor. But will also be useful to access the rugged PC after having installed it in the main box of the system.

- First, right click on the connection logo in the bottom right corner of the screen and click *Edit Connections...* (see figure 30).
- Click on + to add a new connection and select *Wi-Fi* for the Connection Type.

On the tab *General*:

- Check *Connect automatically with priority 1*
- Check *All users may connect to this network*

On the tab *Wi-Fi*:

- Set the mode to *Hotspot*
- Choose a *SSID*: the name that will appear as Wi-Fi network.

On the tab *Wi-Fi Security* (see figure 31).

- Set the security to *WPA & WPA2 Personal*,
- Choose a valid password

- Choose a connection name (on the very top)
- Save
- Close the current window and finally left click on the connection logo, *Create New Wi-Fi Network* (see figure 32) and select your connection in the drop-down list to enable it.

Note: further, you may want to use Wi-Fi connection to get an internet acces. Keep in mind that you can switch the Wi-Fi connection and get back to the previous one by following this last step.

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

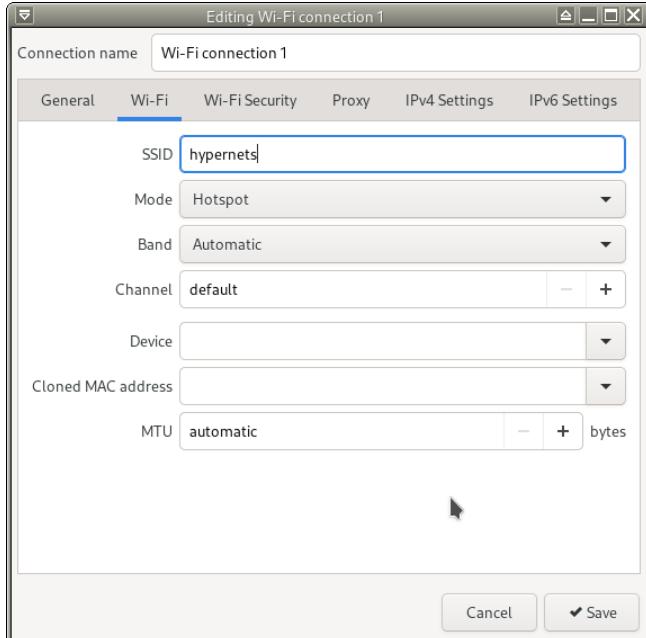


Figure 30: Edit Connections

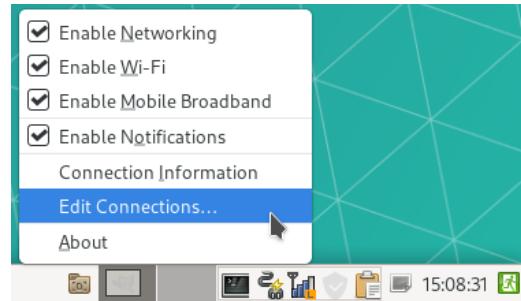


Figure 31: Wi-Fi Connections Access

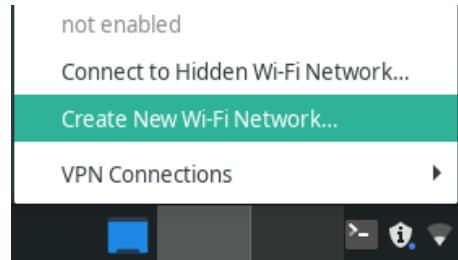


Figure 32: Retrieve Wi-Fi Hotspot

8.2.2 Setting up the Yoctopuce VirtualHub

According to the [Yoctopuce documentation](#):

The VirtualHub is a toolbox for Yoctopuce USB devices. It will allow you to:

- configure and test Yoctopuce devices
- remotely control Yoctopuce devices through network

Here, you should have an updated linux distribution on your rugged PC and a working internet connection wired on it. Open a terminal, clone the installation script repository on your home folder, and run the script with *sudo* privileges:

```
<ctrl + alt + t> # open a terminal
cd
git clone https://github.com/hypernets/hypernets_tools
git checkout beta
cd hypernets_tools/
sudo ./install/00_install_yoctohub.sh
```

You should now be able to run the VirtualHub by typing:

```
/usr/sbin/VirtualHub
```

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

8.2.3 Yocto-Pictor Wi-Fi Connection

Run the VirtualHub (see last command in the previous section), open the web browser and visit the following address:

127.0.0.1:4444

If you don't see a screen like figure 34, please retry instructions from the above section 35.

If you were using Wi-Fi to get Internet, enable the hotspot (see last note from section 34)

Plug the Wi-Fi antenna (see figure 33) and connect the Yocto-Pictor-Wifi with your usb cable on the config port (see figure 35). Click on the button *configure* and edit the *WLAN settings* in the section *Network Configuration*:

1. Select *Infrastructure (choose an existing WLAN)*.
2. Enter the password you choose in section 34.
3. Click on *Test Config* and note the displayed Current IP.
4. Save and exit.

Now, you can come back to your terminal with <ctrl + alt + t> and quit the VirtualHub <ctrl + c>.

Type the IP address followed by ":4444" in the address bar of the web browser and you should see a screen similar to the one before with 3 lines and serials (see figure 36). Note the 3 serials of these devices and the IP address. It will be required later (in the section 37).

Note: at this point you should consider to update the firmwares (see the annex 7.4.1)



Figure 33: Wi-Fi Antenna

Device list

Here is the list of all Yoctopuce devices connected to your host. If you want more information about each of these devices just click on serial numbers. If you want to configure one device, just click on the matching **configure** button. Each **beacon** button will toggle the blue beacon led on matching device allowing you to locate it.

Serial	Logical Name	Description	Action
VIRTHUB0-685d53487	VirtualHub		(configure) (view log file)
OBSVLFR2-13F8CA	Yocto-Pictor-Wifi		(configure) (view log file) (beacon)

Figure 34: Web Interface: Virtual Hub

Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1
Date	September 14, 2023



Figure 35: Yocto-Pictor: top floor
USB connection

Device list

Here is the list of all Yoctopuce devices connected to your host. If you want to control one of these devices just click on serial numbers. If you want to configure a device, click on its matching **configure** button. Each **beacon** button will toggle the device's beacon allowing you to locate it.

Serial	Logical Name	Description
OBSVLFR2-13FB00		Yocto-Pictor-Wifi
OBSVLFR1-13F871		Yocto-Pictor
YGNSSMK2-13F53E		Yocto-GPS-V2

Figure 36: Web Interface: serial

8.3 Linking Hypernets Tools to the Yocto-Pictor

If not already done, first copy the two configuration file templates in the *hypernets_tools* folder:

```
cd hypernets_tools/
cp hypernets/resources/config_dynamic.ini.template config_dynamic.ini
cp hypernets/resources/config_static.ini.template config_static.ini
```

Connect the PC to the internet, go to the folder *hypernets_tools* and install required dependencies:

```
cd hypernets_tools/
sudo ./install/01_dependencies.sh
```

Now copy the template of the static configuration file (see description in annex 7.1) and edit the Yoctopuce section according to the serial that you previously noted in the section 36:

```
cp hypernets/resources/static_config.ini.template static_config.ini
mousepad static_config.ini
```

If necessary, mind to switch back the Wi-Fi connection to the hotspot mode (8.2.1) and try to run the Graphical User Interface (GUI) with:

```
python -m hypernets.gui.frame_yoctopuce
```

You should see some meteo and GPS data after clicking on *Connection*. Also you can try playing with relays to check if everything is working (see figure 37).

	Reference	HYPERNETS_D4.7_User_Manual_V2.1
Version	2.1	
Date	September 14, 2023	

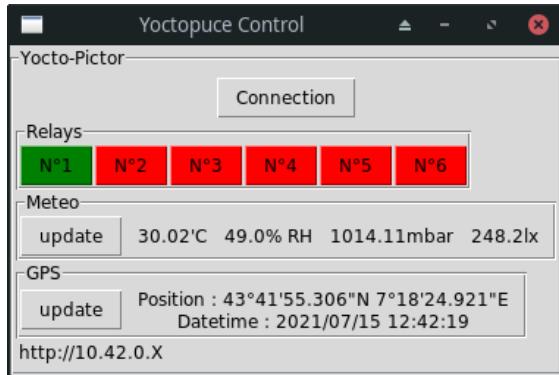


Figure 37: GUI Yoctopuce Control

8.3.1 Radiometer Configuration and First tests with the GUI

- Yocto-Pictor
- USB 2.0 cable of type A-micro B (data + power)

Open a terminal and type the following command in order to link the radiometer to a *device file*:

```
sudo ./install/02_configure_ports.sh
```

This should output with something like:

```
lrwxrwxrwx 1 root root 7 Jul 15 15:04 /dev/radiometer0 -> ttyUSB5
```

Type the following command (required internet connection) to update the *libhypstar driver*:

```
sudo ./install/03_update_libhypstar.sh
```