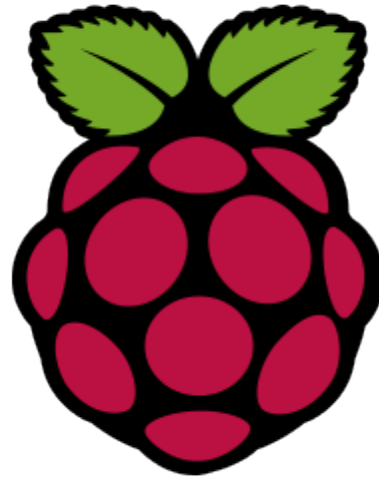


# Orange Pi, C.H.I.P i Raspberry Pi



22 d'abril de 2017



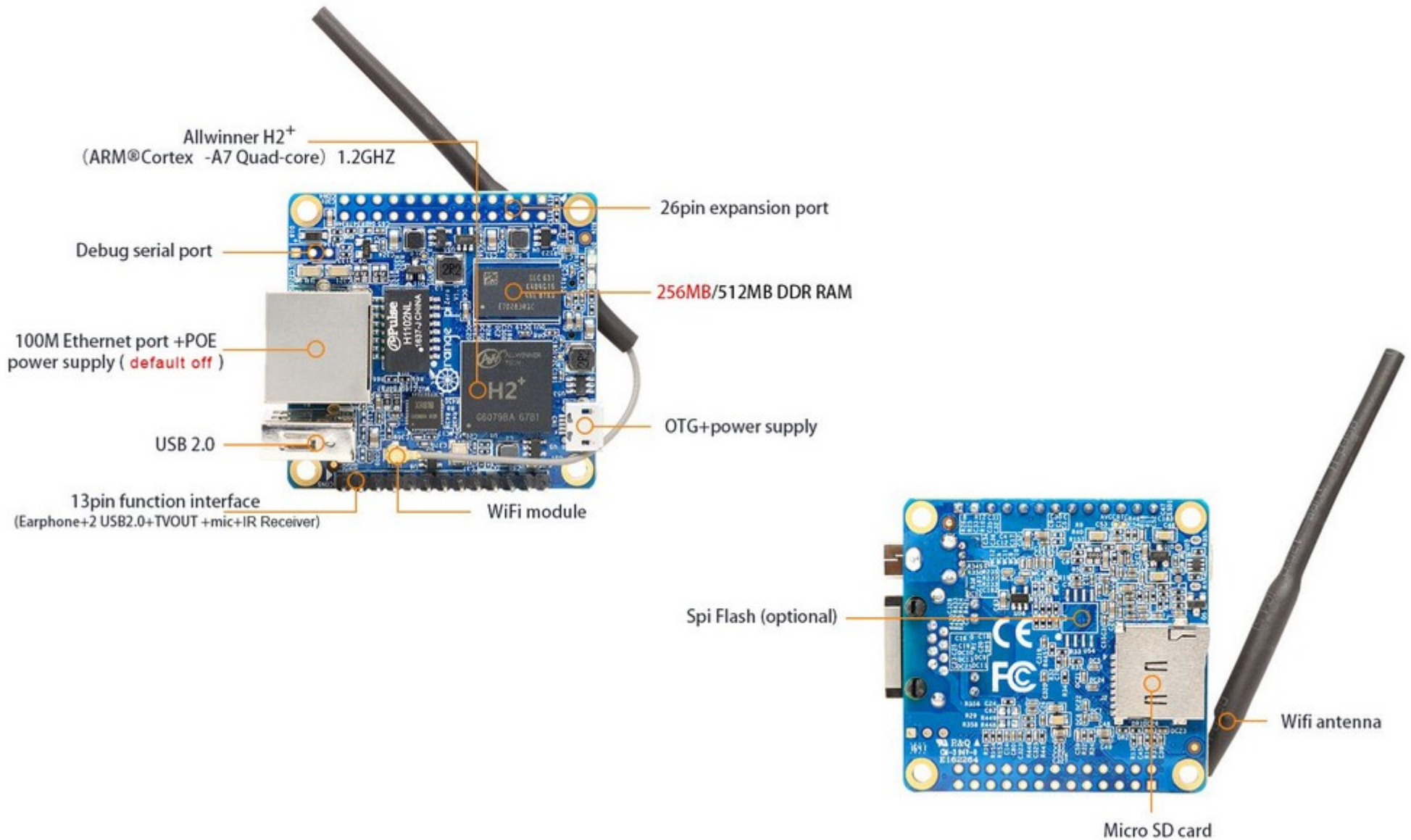
JESUÏTES El Clot  
Escola del Clot

*Jordi Binefa i Martínez*



# Orange Pi, C.H.I.P. i Raspberry Pi

## Orange Pi Zero



<http://www.orangepi.org/orangepizero/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Característiques de l'Orange Pi Zero

### Hardware specification

|                       |  |
|-----------------------|--|
| CPU                   | H2 Quad-core <a href="#">Cortex-A7</a> H.265/HEVC 1080P.   |
| GPU                   | <ul style="list-style-type: none"> <li>· Mali400MP2 GPU @600MHz</li> <li>· Supports OpenGL ES 2.0</li> </ul> |
| Memory (SDRAM)        | 256MB/512MB DDR3 SDRAM(Share with GPU)(256MB version is Standard version)                                    |
| Onboard Storage       | TF card (Max. 64GB)/ NOR Flash(2MB Default not posted)   |
| Onboard Network       | <b>10/100M</b> Ethernet RJ45 POE is default off.   |
| Onboard WIFI          | XR819, IEEE 802.11 b/g/n   |
| Audio Input           | MIC  |
| Video Outputs         | Supports external board via 13pins   |
| Power Source          | USB OTG can supply power   |
| USB 2.0 Ports         | Only One USB 2.0 HOST, one USB 2.0 OTG   |
| Buttons               | Power Button   |
| Low-level peripherals | 26 Pins Header, compatible with Raspberry Pi B+<br><br>13 Pins Header, with 2x USB, IR pin, AUDIO(MIC, AV)   |
| LED                   | Power led & Status led   |
| Supported OS          | Android, Ubuntu, Debian, Raspbian  |

<http://www.orangepi.org/orangepizero/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Orange Pi Zero

L'Orange Pi Zero és un ordinador de placa única (SBC) de baix cost:

- és molt compacte (aprox. 46 x 48 mm). 26 grams de pes.
- sense connexió HDMI, ideal per aplicacions encastades.
- amb Wi-Fi (de disseny propietari) i Ethernet.
- és bastant potent, té un Allwinner H2 + sistema-en-xip (SoC) que ofereix un processador de quatre nuclis ARM Cortex-A7. Especificacions completes i altra informació útil està disponible a [wiki linux-sunxi.org](http://wiki.linux-sunxi.org).
- el suport de Linux és molt bo, gràcies a Armbian.
- és molt barata.



**Orange Pi Zero H2+ Quad Core**  
Open-source 256MB  
development board beyond  
Raspberry PI

€ 6,62 / piece

Shipping: € 3,42 / lot via AliExpress



**Orange Pi Zero Set 6: Orange Pi Zero 512MB+Expansion Board+Black Case**  
development board beyond Raspberry PI

€ 12,27 / piece

Shipping: € 5,46 / lot via AliExpress

<http://lucsmall.com/2017/01/19/beginners-guide-to-the-orange-pi-zero/>





# Orange Pi, C.H.I.P. i Raspberry Pi

## Sistemes Operatius oficials per l'Orange Pi Zero

← → ↻ [www.orangepi.org/downloadresources/](http://www.orangepi.org/downloadresources/)

Aplicacions TaulaProgramació

### Orange Pi Zero



Android(Orange OS)

updated:2016-11-24

Download Now



Lubuntu desktop

updated:2016-11-25

Download Now



ubuntu server

updated:2016-11-24

Download Now

android sdk source code

updated:2016-11-24

Download Now



Debian xfce desktop

updated:2016-12-05

Download Now



Debian Server

updated:2016-12-01

Download Now

<http://www.orangepi.org/downloadresources/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Sistema Operatiu Armbian per l'Orange Pi Zero



<https://www.armbian.com/orange-pi-zero/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Sistema Operatiu Armbian per l'Orange Pi Zero

### Orange Pi Zero

allwinner H2+ legacy SPI flash WIFI

Server Quick start Known issues Nightly releases Kernels

Legacy 3.4.113

Debian Jessie

Ubuntu Xenial

Mainline

No stable releases yet. Check [nightly releases](#) tab to see if experimental images are available.

Board family info

Support forums

Hardware details

SD card burning tool

Older images

- serial console gadget on the OTG port is available after the system boots up. Please make sure that board is properly powered (i.e. with microUSB Y cable or via GPIO pins) because a standard PC USB port will not provide enough current to the board
- it is possible to boot Armbian images from USB storage if a proper mainline u-boot is programmed to the onboard SPI flash

<https://www.armbian.com/orange-pi-zero/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Sistema Operatiu Armbian per l'Orange Pi Zero

### How to boot?

Insert SD card into a slot and power the board. First boot takes around 3 minutes then it might reboot and you will need to wait another one minute to login. This delay is because system creates 128Mb emergency SWAP and expand SD card to it's full capacity. Worst case scenario boot (with DHCP) takes up to 35 seconds.

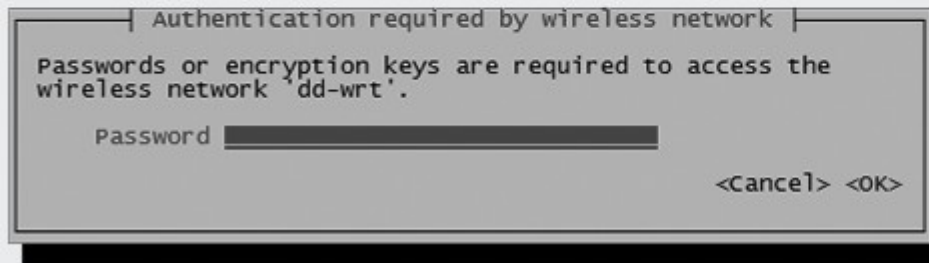
### How to login?

Login as **root** on HDMI / serial console or via SSH and use password **1234**. You will be prompted to change this password at first login. Next you will be asked to create a normal user account that is sudo enabled (beware of default QWERTY keyboard settings at this stage).

### How to connect to your router via WIFI?

Required condition: a board with onboard or supported 3rd party wireless adapter on USB

```
nmtui-connect YOUR_ROUTER_SSID
```



<https://www.armbian.com/orange-pi-zero/>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Armbian sobre Orange Pi Zero



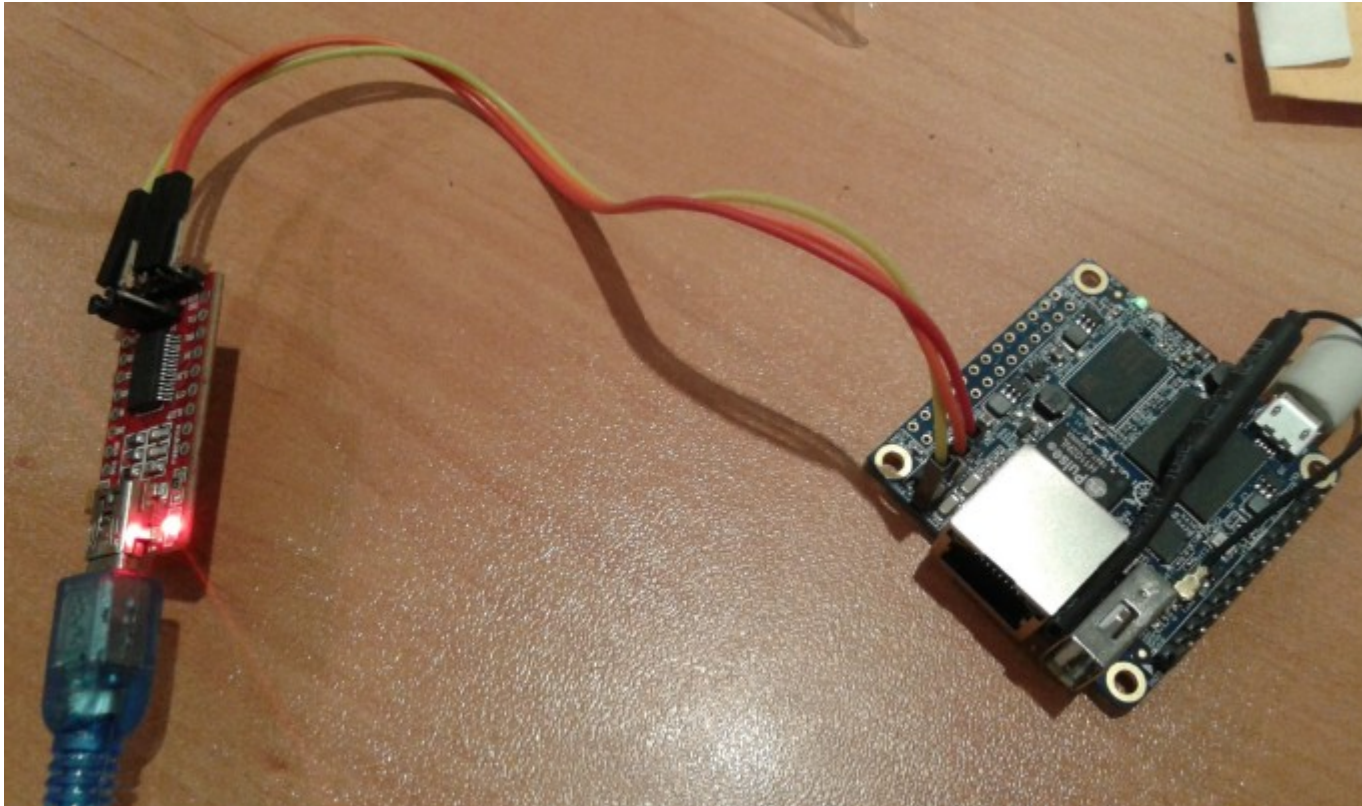
```
jordi@orangezero: ~  
Fitxer Edita Visualitza Cerca Terminal Ajuda  
jordi@debianJB:~$ ssh jordi@192.168.42.133  
  
@ORANGEPIZERO@  
  
Welcome to ARMBIAN 5.25 stable Debian GNU/Linux 8 (jessie) 3.4.113-sun8i  
System load: 0.67 Up time: 45 sec  
Memory usage: 10 % of 494Mb IP: 192.168.1.18,192.168.42.133  
CPU temp: 34°C  
Usage of /: 8% of 15G  
  
Last login: Fri Mar 24 10:52:20 2017 from 192.168.42.171  
jordi@orangezero:~$
```





# Orange Pi, C.H.I.P. i Raspberry Pi

## Connexió a l'Orange Pi Zero

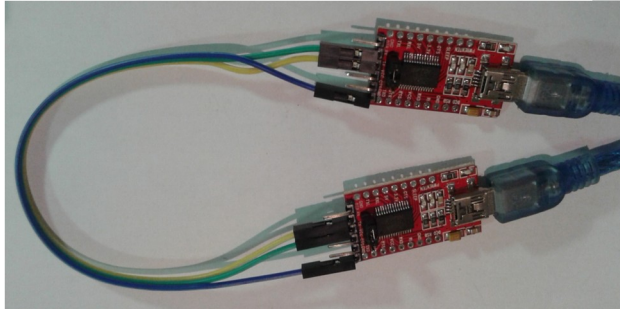


<https://twitter.com/JordiBinefa/status/845206766925369344>



# Orange Pi, C.H.I.P. i Raspberry Pi

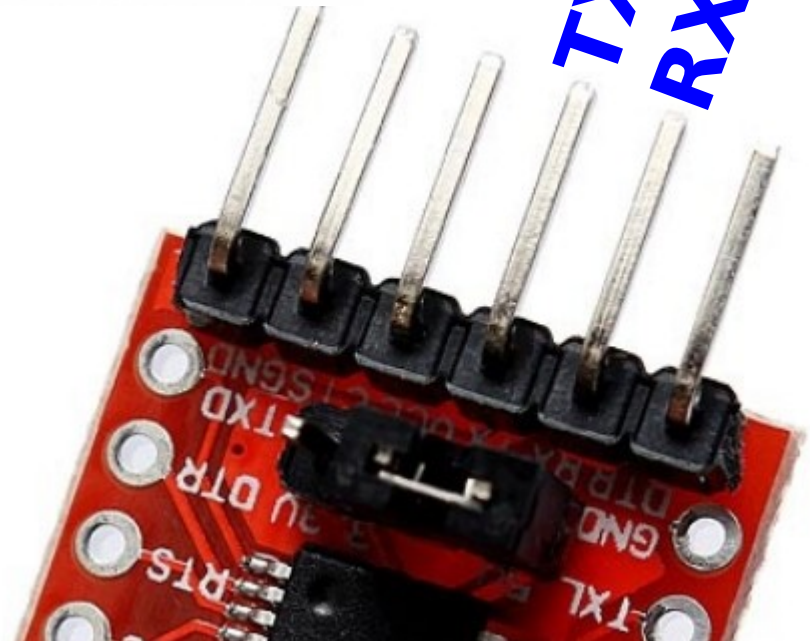
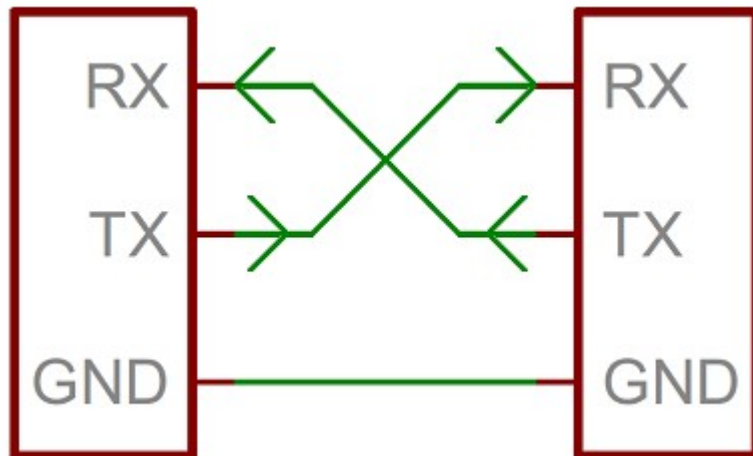
## Connexió a l'Orange Pi Zero



El pont ha d'estar a 3,3V  
i no pas a 5V

**GND**

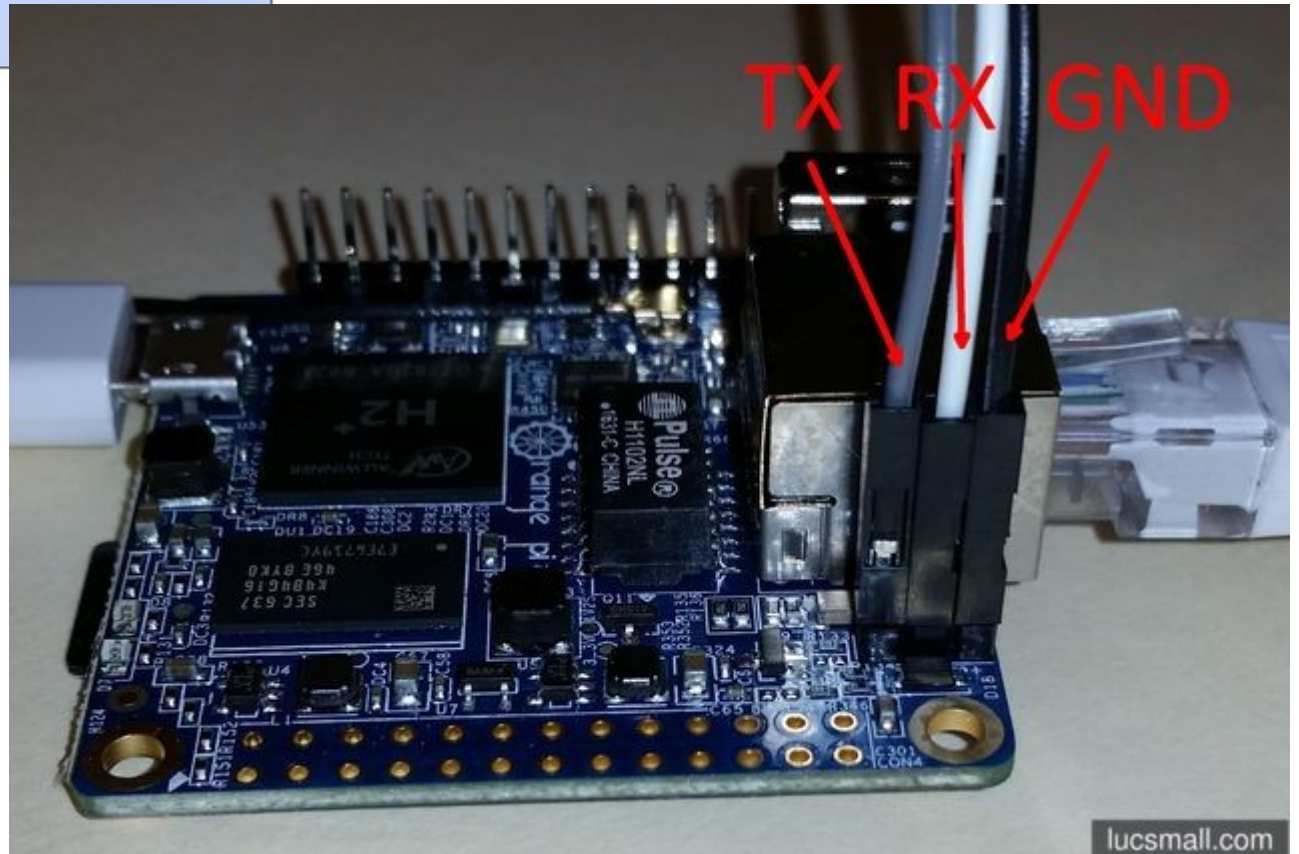
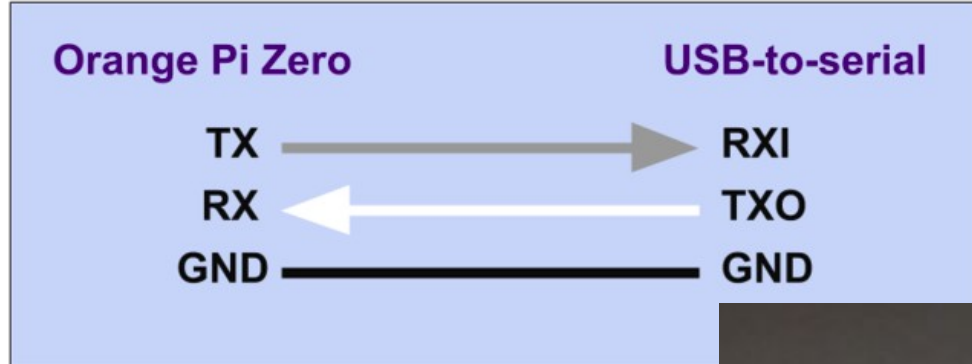
**TX**  
**RX**





# Orange Pi, C.H.I.P. i Raspberry Pi

## Connexió a l'Orange Pi Zero



<http://lucsmall.com/2017/01/19/beginners-guide-to-the-orange-pi-zero/>





# Orange Pi, C.H.I.P. i Raspberry Pi

## Connexió a l'Orange Pi Zero

```
[ecat@web577 ~]$ ssh pi@127.0.0.1 -p 19989
pi@127.0.0.1's password:
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Sat Apr 22 01:03:32 2017 from localhost
```

```
pi@eficook:~$ screen /dev/ttyUSB0 115200
```

```
Password:
```

```
Last login: Tue Apr 11 15:41:00 CEST 2017 on ttyS0
```

```
Linux orangepi-zero 3.4.113-sun8i #10 SMP PREEMPT Thu Feb 23 19:55:00 CET 2017 armv7l
```



```
Welcome to ARMBIAN 5.25 stable Debian GNU/Linux 8 (jessie) 3.4.113-sun8i
```

```
System load: 0.00
```

```
Up time: 21 days
```

```
Memory usage: 22 % of 241Mb
```

```
Swap usage: 1 % of 127Mb
```

```
IP:
```

```
192.168.1.39
```

```
CPU temp: 35°C
```

```
Usage of /: 39% of 3.5G
```

```
jordi@orangepi-zero:~$ exit
```

```
logout
```

```
Debian GNU/Linux 8 orangepi-zero ttyS0
```

```
orangepi-zero login: █
```

```
pi@eficook: ~
```



# Orange Pi, C.H.I.P. i Raspberry Pi

## Temperatura de la CPU d'Orange Pi Zero

```
jordi@orangepizero:~$ cat /sys/class/thermal/thermal_zone1/temp
62
jordi@orangepizero:~$ cat /sys/class/thermal/thermal_zone1/temp
60
jordi@orangepizero:~$ cat /sys/class/thermal/thermal_zone1/temp
61
jordi@orangepizero:~$ cat /sys/class/thermal/thermal_zone1/temp
43
jordi@orangepizero:~$ cat /sys
43
jordi@orangepizero:~$ cat /sys
45
```



<https://twitter.com/JordiBinefa/status/847402939706523648>





# Orange Pi, C.H.I.P. i Raspberry Pi

## NodeRed i MQTT a l'Orange Pi

Node-RED: Adding Node x node-red-contrib-opi-gp x Node-RED: 172.31.0.206 x

172.31.0.206:1880/

Apps Publication Bookmarks Sony Autodesk Student Cor Patent iee IBM course articles infographic smart plant box sensor gateway FameLab Vietnam

Node-RED Deploy

filter nodes

Flow 1

tail file file

analysis

sentiment

advanced

watch feedparse exec

Orange Pi

output pin input pin

info debug

Your flow configuration nodes are listed in the sidebar panel. It can be accessed from the menu or with `ctrl-g c`

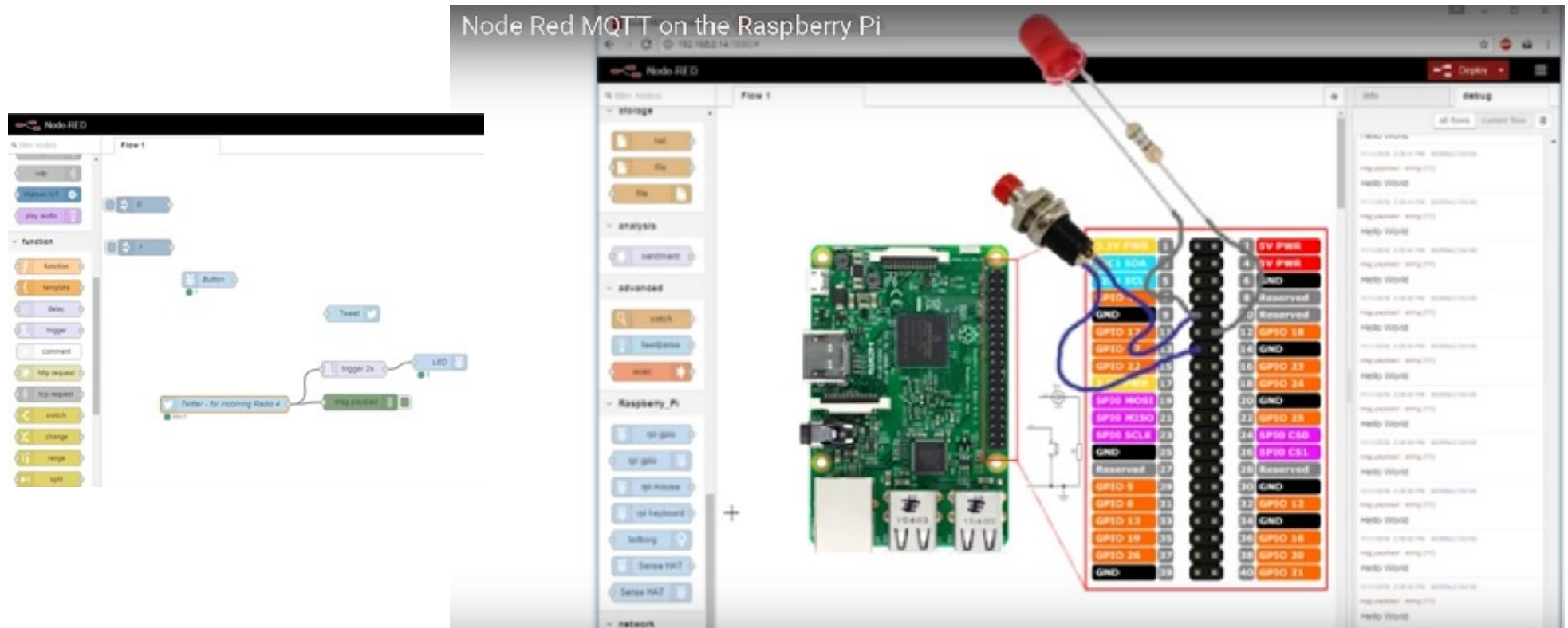
Ask me anything

12:02 AM 3/23/2017

[https://agrinode.github.io/docs/install\\_nodered\\_orangepi/](https://agrinode.github.io/docs/install_nodered_orangepi/)

# Orange Pi, C.H.I.P. i Raspberry Pi

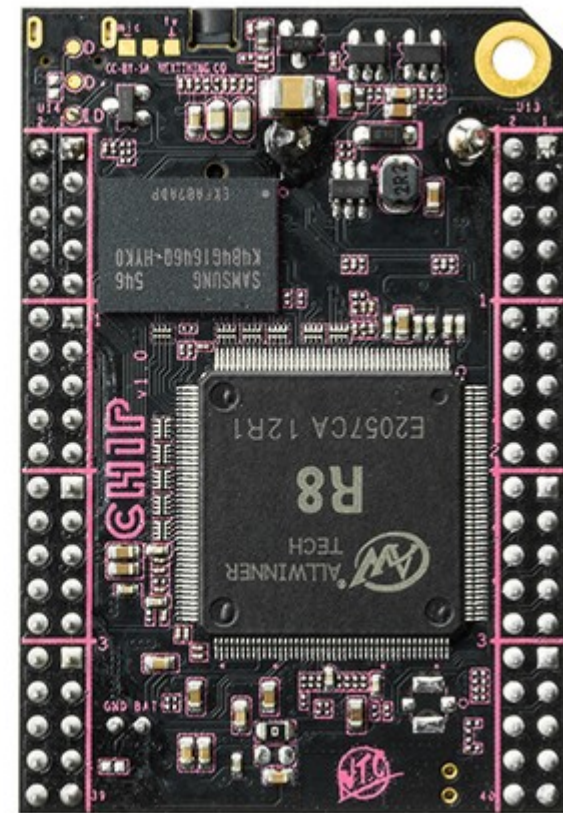
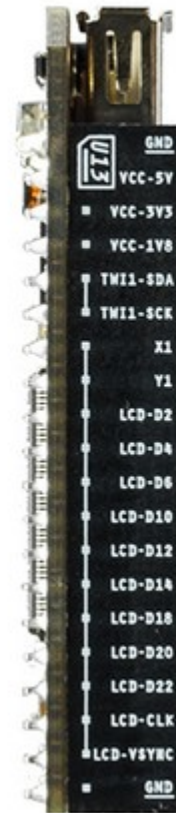
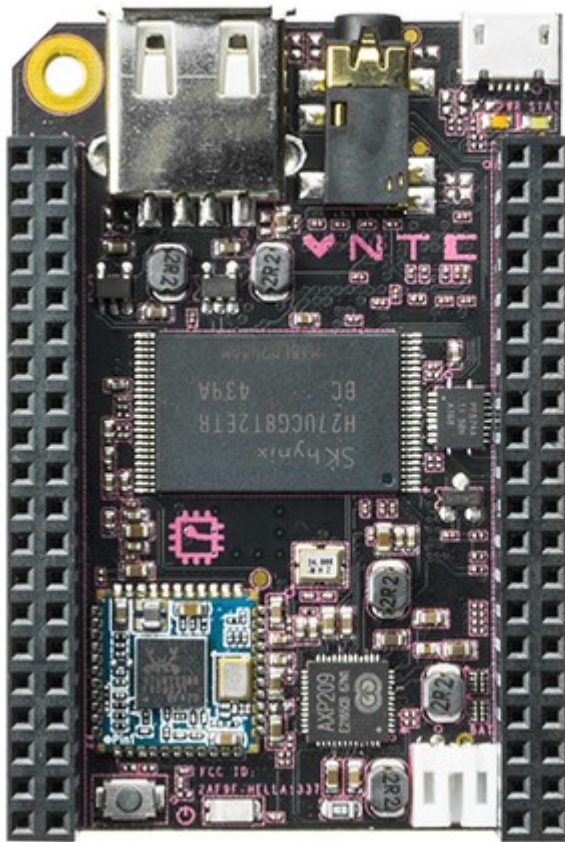
## NodeRed i MQTT a la Raspberry Pi





# Orange Pi, C.H.I.P. i Raspberry Pi

## C.H.I.P.



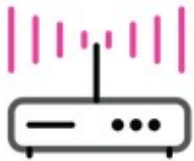
<https://getchip.com/pages/chip>



# Orange Pi, C.H.I.P. i Raspberry Pi

## C.H.I.P.

### C.H.I.P. has specs!



#### WiFi B/G/N Built-in!

Plug C.H.I.P. in and hop on the internet in 60 seconds flat.



#### 1GHz Processor

C.H.I.P.'s R8 processor allows C.H.I.P. to be small and powerful enough to handle any task you can throw at it.



#### 4GB of High-speed Storage

C.H.I.P. comes with storage onboard, so there's no need to purchase an SD card. C.H.I.P. is ready to go.



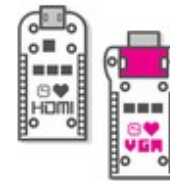
#### 512MB of RAM

C.H.I.P. comes with enough RAM to start your projects right away.



#### Bluetooth 4.0

Wirelessly connect keyboards, mice, and controllers to C.H.I.P. With a few clicks and an old stereo, turn C.H.I.P. into an AirPlay or Bluetooth speaker.



#### C.H.I.P. Works with ANY Display

C.H.I.P. is designed to work with any screen. Old or new. Big or small. Connect via C.H.I.P.'s built-in composite output or add a simple adapter for either VGA or HDMI.

<https://getchip.com/pages/chip>





# Orange Pi, C.H.I.P. i Raspberry Pi

## C.H.I.P.

https://getchip.com/pages/chip

CHIP PocketCHIP

We're upgrading C.H.I.P. with GR8, our very own microchip!

Have a design suggestion? Submit it [here!](#)

Want to be notified of the launch announcement? [Sign up for the NTC Newsletter!](#)

**CHIP**

*The World's First \$9 Computer!*

*The C.H.I.P. GR8 Upgrade is in Progress!*

<https://getchip.com/pages/chip>





# Orange Pi, C.H.I.P. i Raspberry Pi

## C.H.I.P.


[CHIP](#)
[PocketCHIP](#)
[CHIP Pro](#)
[Dashbot](#)
[Store](#)
[Blog](#)
[Forum](#)
[Docs](#)

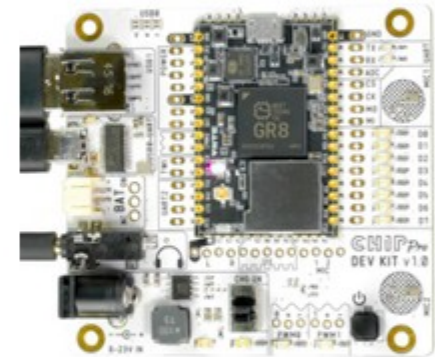

## Things we make



INCLUDES  
**PICO-B**



INCLUDES  
**PICO-B**



### PocketC.H.I.P. Console Kit

\$ 79.00

Includes a PocketC.H.I.P., a controller, and a Power Brick with USB Cable!  
Includes PICO-B! **Currently on back-order. Estimated Shipping June 2017.**

Quantity:

1

Add to Cart

### PocketC.H.I.P.

\$ 69.00

[Learn More](#)

C.H.I.P. and C.H.I.P. case included! Charger sold separately. **Currently on back-order. Estimated Shipping June 2017.**

Quantity:

1

Add to Cart

### C.H.I.P. Pro Dev Kit

\$ 49.00

[Learn More](#)

Includes 1 C.H.I.P. Pro SMT soldered to Dev Kit Board, 1 C.H.I.P. Pro, header pins, breadboard, button with button cap, USB cable, and jumper wires in a zipper case. **Ships in May.**

Quantity:

1

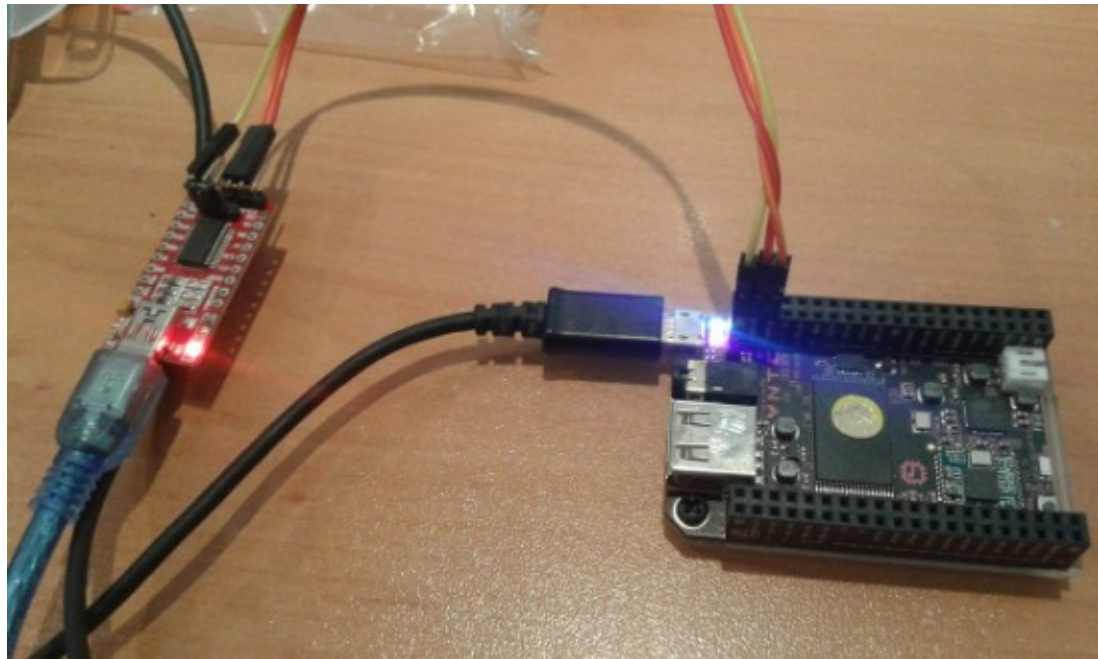
Add to Cart

<https://getchip.com/pages/chip>



# Orange Pi, C.H.I.P. i Raspberry Pi

## Connexió a C.H.I.P.





# Orange Pi, C.H.I.P. i Raspberry Pi

## Connexió a WiFi del C.H.I.P.

← → ↻ Segur | <https://docs.getchip.com/chip.html#connecting-c-h-i-p-to-wi-fi-with-nmcli>

Aplicacions TaulaProgramació

- CHIP Hardware
- Making Stuff
- Flash CHIP With an OS
- Advanced
- Installing C.H.I.P. SDK
- Flash CHIP Firmware
- Setup Ubuntu For Flashing
- WiFi Connection
  - Connecting C.H.I.P. to Wi-Fi w...**
  - Connecting C.H.I.P. to a Wirel...
- Configure Sound Output on De...
- USB Storage Devices
- Connecting Bluetooth Devices

In the terminal, type

```
nmcli device wifi list
```

The output will list available access points

| * SSID      | MODE | CHAN  | RATE | SIGNAL    | BARS | SECURITY  |
|-------------|------|-------|------|-----------|------|-----------|
| * NextThing | HQ   | Infra | 11   | 54 Mbit/s | 100  | --        |
| NextThing   | Shop | Infra | 6    | 54 Mbit/s | 30   | WPA1 WPA2 |
| 2WIRE533    |      | Infra | 10   | 54 Mbit/s | 44   | WPA1 WPA2 |

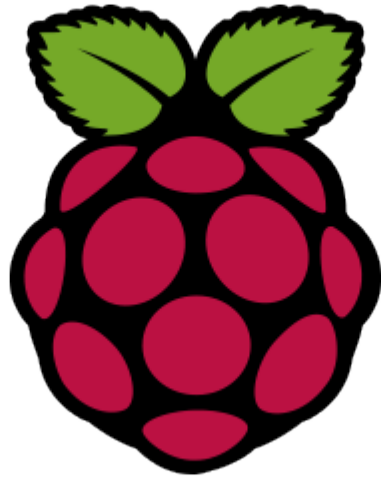
### B: Password Protected

To connect to a password protected network, use this command, inserting your own network name and password:

```
sudo nmcli device wifi connect '(your wifi network name/SSID)' password '(your wifi password)' ifname wlan0
```

<https://docs.getchip.com/chip.html#connecting-c-h-i-p-to-wi-fi-with-nmcli>

# Comunicacions amb Raspberry Pi



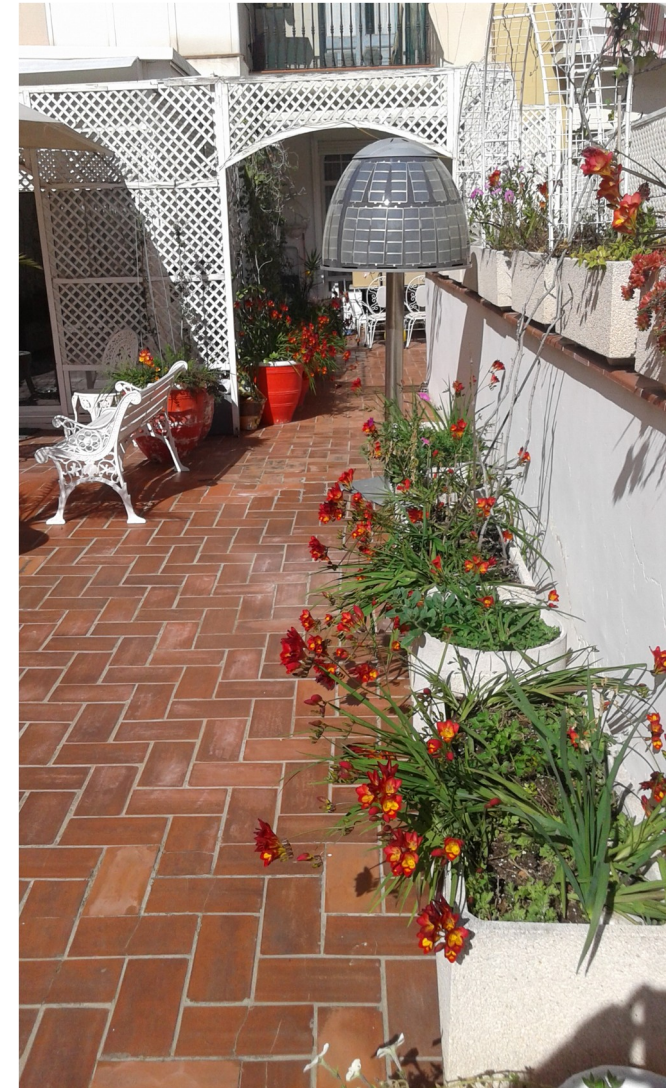
11 de març de 2017

*Jordi Binefa i Martínez*



# Comunicacions amb Raspberry Pi

## Exemples

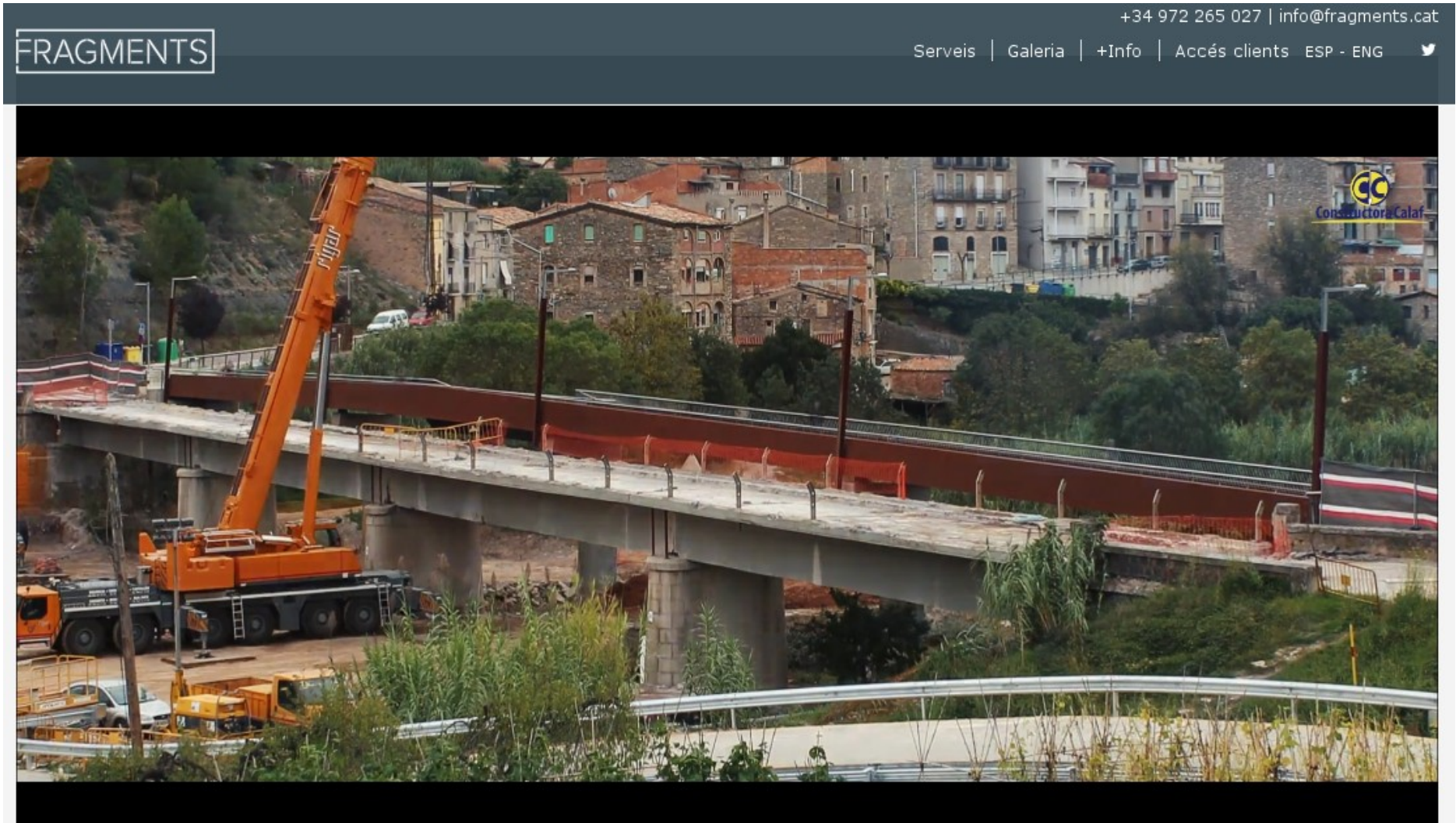


<http://siarq.com/>



# Comunicacions amb Raspberry Pi

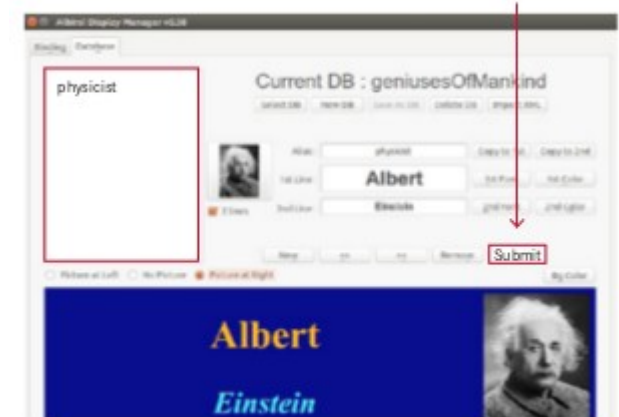
## Exemples



<http://www.fragments.cat/projectes-seguiment-obres/>

# Comunicacions amb Raspberry Pi

## Exemples



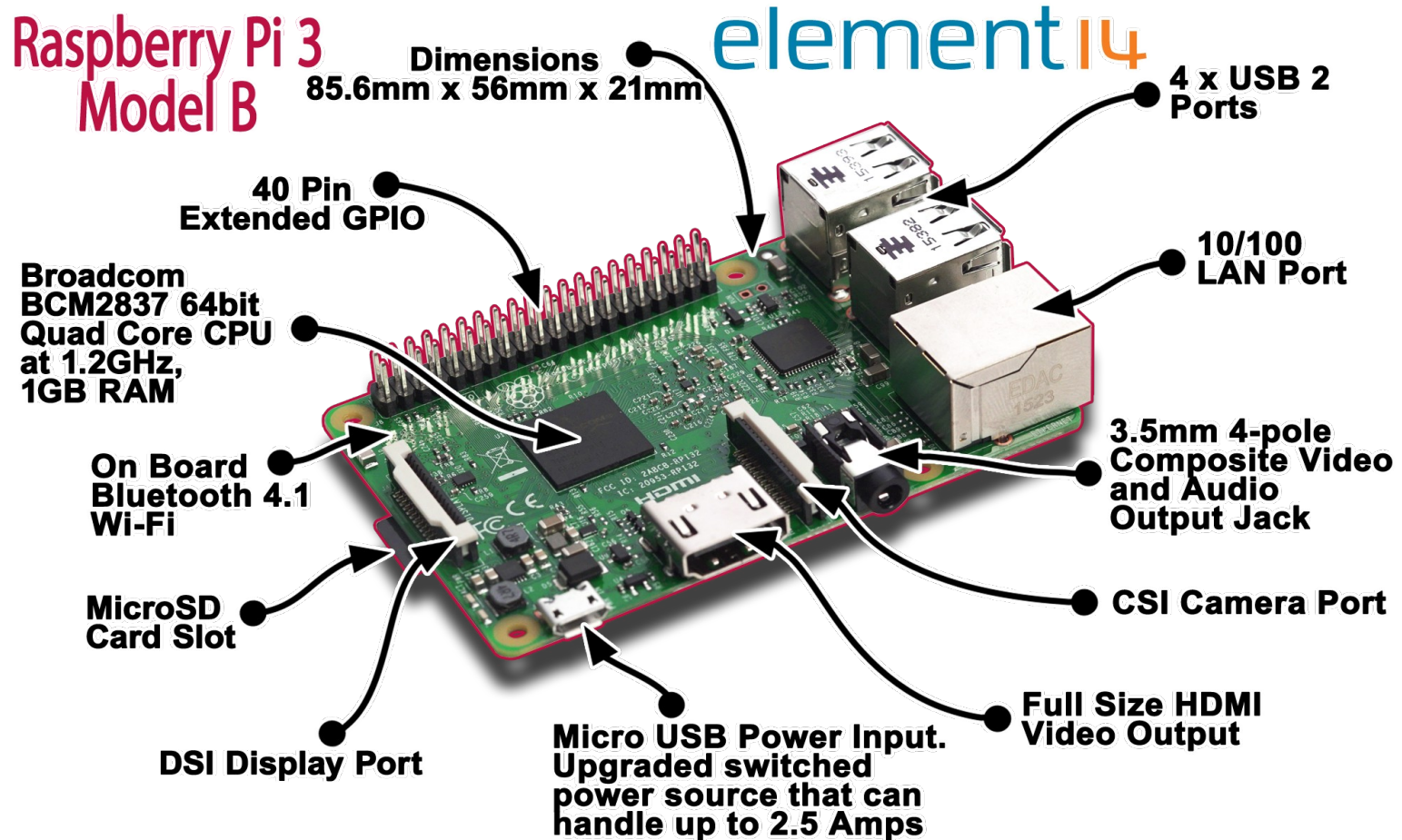
<http://www.arthurholm.com/>





# Comunicacions amb Raspberry Pi

## La Raspberry Pi



<http://www.raspberrypi.org/>

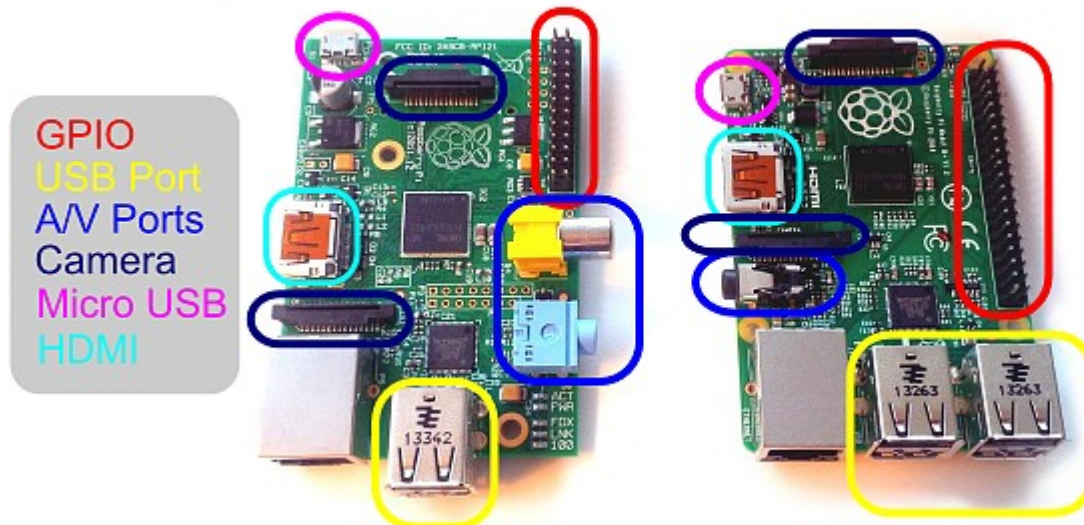


# Comunicacions amb Raspberry Pi

## La Raspberry Pi

Raspberry Pi B

Raspberry Pi B+



<https://helloacm.com/review-raspberry-pi-b-plus-model/>

Raspberry Pi: Which model do I have?



© 2014 Pimoroni Ltd



<http://pimoroni.com>

<http://misapuntedesde.com/post.php?id=431>



# Comunicacions amb Raspberry Pi

## La Raspberry Pi

- Sortida de vídeo HDMI i vídeo compost
- Es poden fer servir connectors DVI o VGA amb un adaptor
- Les pantalles tàctils HDMI funcionen si emulen un ratolí USB
- Chalkboard Electronics té una pantalla tàctil compatible de 10 polsades amb una interfície d'HDMI a LVDS





# e⚙️ Comunicacions amb Raspberry Pi

## La Raspberry Pi

- Ports GPIO, sèrie, SPI, I2C i JTAG
- Ve amb un connector soldat (P1) de 26 pines i un altre de 8 pines (P5. Tan sols està a la segona revisió)
- Treballa internament a 3,3V. Si es vol fer compatible amb nivells TTL (5V) cal un convertidor de nivells
- MIPI CSI-2 (Camera Serial Interface) al connector S5
- DSI (Display Serial Interface) al connector S2 per a LCD (no hi ha drivers actualment)
- La segona revisió té alguns canvis menors respecte a l'original



# Connector GPIO

## GPIO Numbers

Raspberry Pi B  
Rev 1 P1 GPIO Header

| Pin No.     |       |            |
|-------------|-------|------------|
| <b>3.3V</b> | 1 2   | <b>5V</b>  |
| GPIO0       | 3 4   | <b>5V</b>  |
| GPIO1       | 5 6   | <b>GND</b> |
| GPIO4       | 7 8   | GPIO14     |
| <b>GND</b>  | 9 10  | GPIO15     |
| GPIO17      | 11 12 | GPIO18     |
| GPIO21      | 13 14 | <b>GND</b> |
| GPIO22      | 15 16 | GPIO23     |
| <b>3.3V</b> | 17 18 | GPIO24     |
| GPIO10      | 19 20 | <b>GND</b> |
| GPIO9       | 21 22 | GPIO25     |
| GPIO11      | 23 24 | GPIO8      |
| <b>GND</b>  | 25 26 | GPIO7      |

Raspberry Pi A/B  
Rev 2 P1 GPIO Header

| Pin No.     |       |            |
|-------------|-------|------------|
| <b>3.3V</b> | 1 2   | <b>5V</b>  |
| GPIO2       | 3 4   | <b>5V</b>  |
| GPIO3       | 5 6   | <b>GND</b> |
| GPIO4       | 7 8   | GPIO14     |
| <b>GND</b>  | 9 10  | GPIO15     |
| GPIO17      | 11 12 | GPIO18     |
| GPIO27      | 13 14 | <b>GND</b> |
| GPIO22      | 15 16 | GPIO23     |
| <b>3.3V</b> | 17 18 | GPIO24     |
| GPIO10      | 19 20 | <b>GND</b> |
| GPIO9       | 21 22 | GPIO25     |
| GPIO11      | 23 24 | GPIO8      |
| <b>GND</b>  | 25 26 | GPIO7      |

Raspberry Pi B+  
B+ J8 GPIO Header

| Pin No.     |       |            |
|-------------|-------|------------|
| <b>3.3V</b> | 1 2   | <b>5V</b>  |
| GPIO2       | 3 4   | <b>5V</b>  |
| GPIO3       | 5 6   | <b>GND</b> |
| GPIO4       | 7 8   | GPIO14     |
| <b>GND</b>  | 9 10  | GPIO15     |
| GPIO17      | 11 12 | GPIO18     |
| GPIO27      | 13 14 | <b>GND</b> |
| GPIO22      | 15 16 | GPIO23     |
| <b>3.3V</b> | 17 18 | GPIO24     |
| GPIO10      | 19 20 | <b>GND</b> |
| GPIO9       | 21 22 | GPIO25     |
| GPIO11      | 23 24 | GPIO8      |
| <b>GND</b>  | 25 26 | GPIO7      |
| <b>DNC</b>  | 27 28 | <b>DNC</b> |
| GPIO5       | 29 30 | <b>GND</b> |
| GPIO6       | 31 32 | GPIO12     |
| GPIO13      | 33 34 | <b>GND</b> |
| GPIO19      | 35 36 | GPIO16     |
| GPIO26      | 37 38 | GPIO20     |
| <b>GND</b>  | 39 40 | GPIO21     |

### Key

|                       |             |
|-----------------------|-------------|
| <b>Power +</b>        | <b>UART</b> |
| <b>GND</b>            | <b>SPI</b>  |
| <b>I<sup>2</sup>C</b> | <b>GPIO</b> |

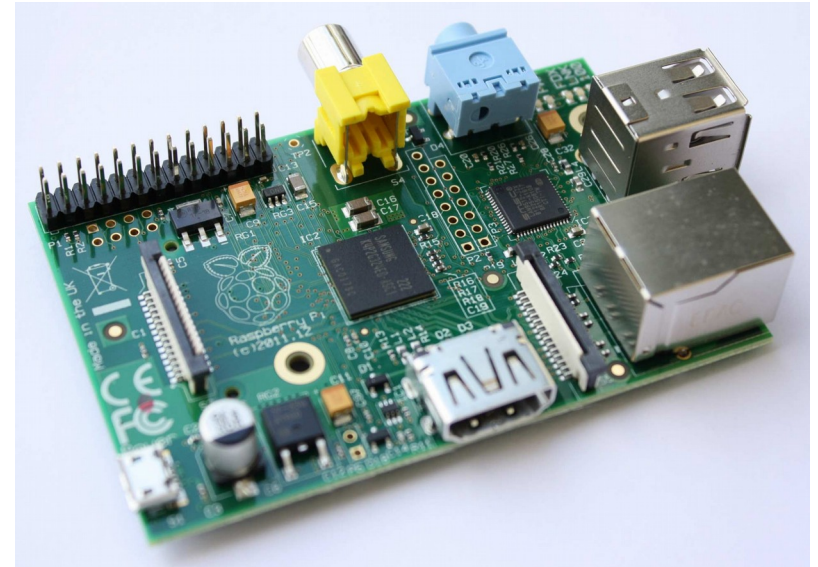


# Raspberry Pi Model B

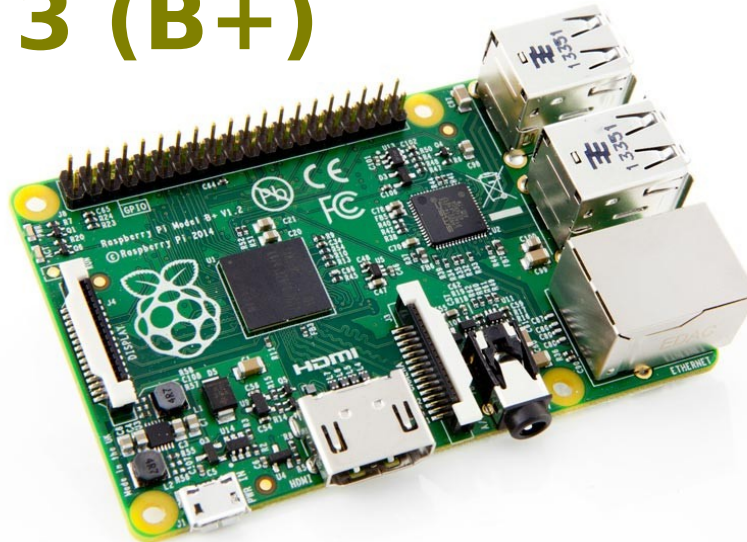
**Rev 1**



**Rev 2**



**Rev 3 (B+)**

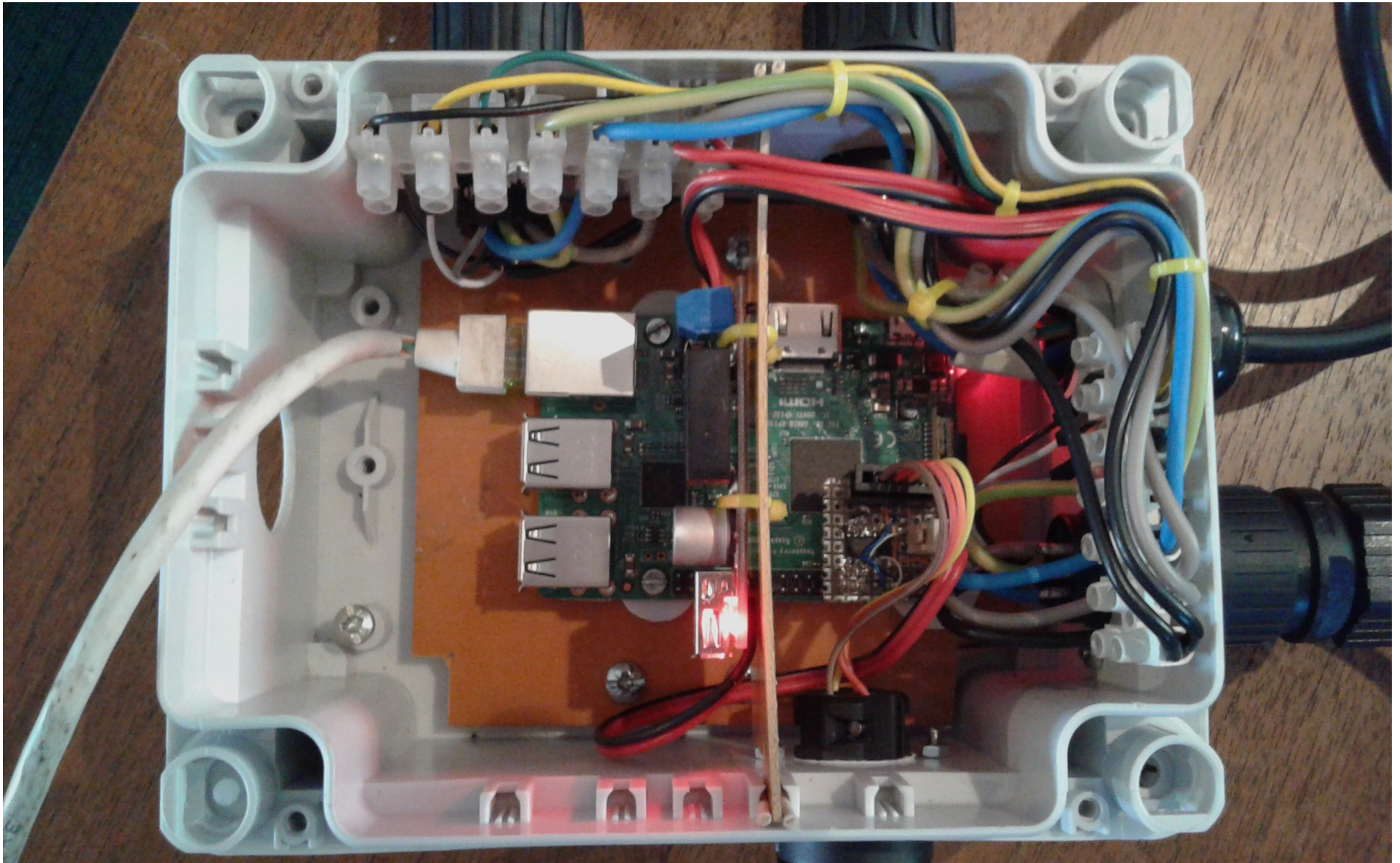






# Comunicacions amb Raspberry Pi

## Connexió amb altre maquinari







# Comunicacions amb Raspberry Pi

## Connexió amb altre maquinari

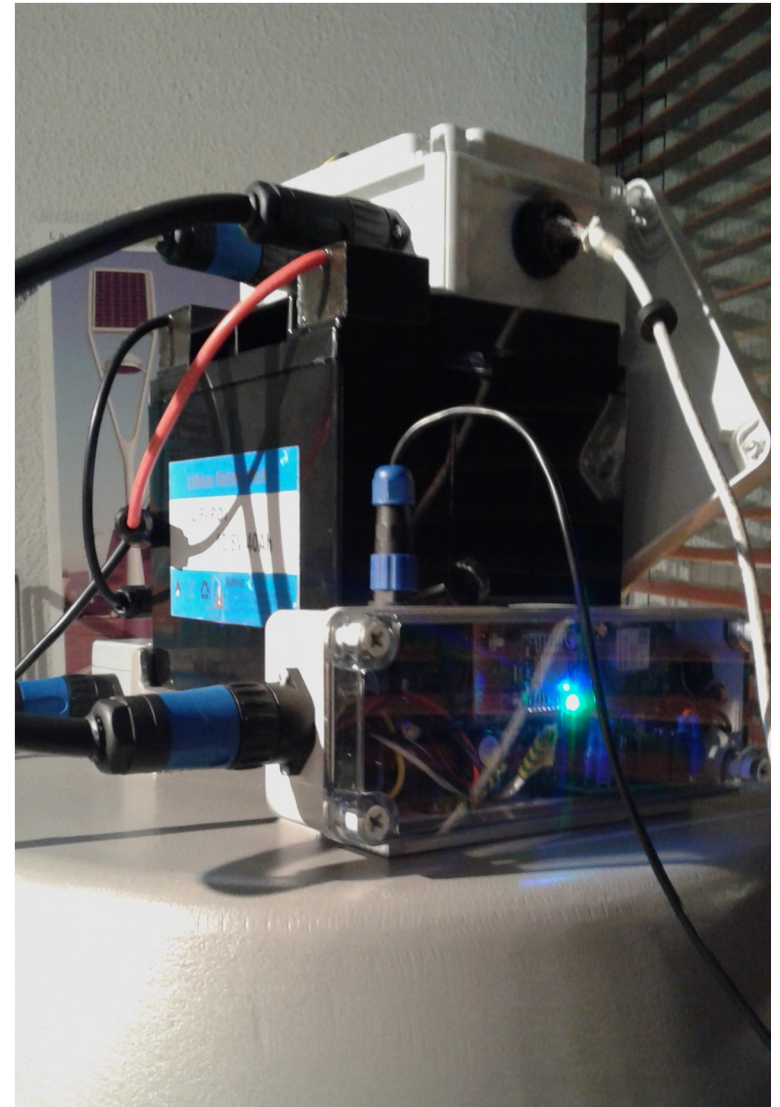
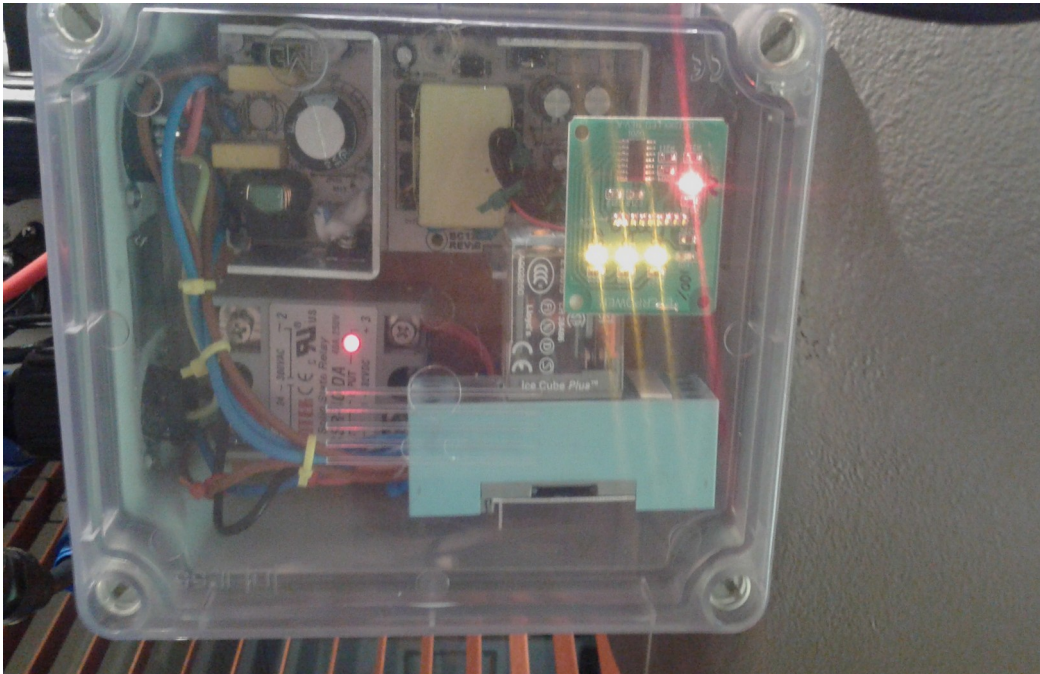






# Comunicacions amb Raspberry Pi

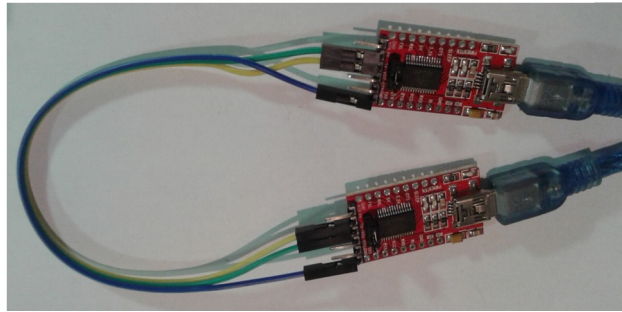
## Connexió amb altre maquinari





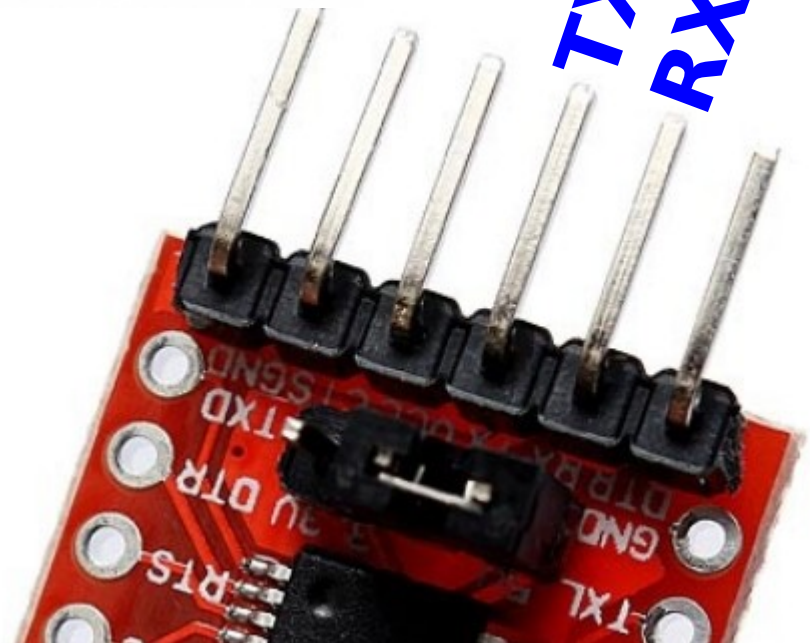
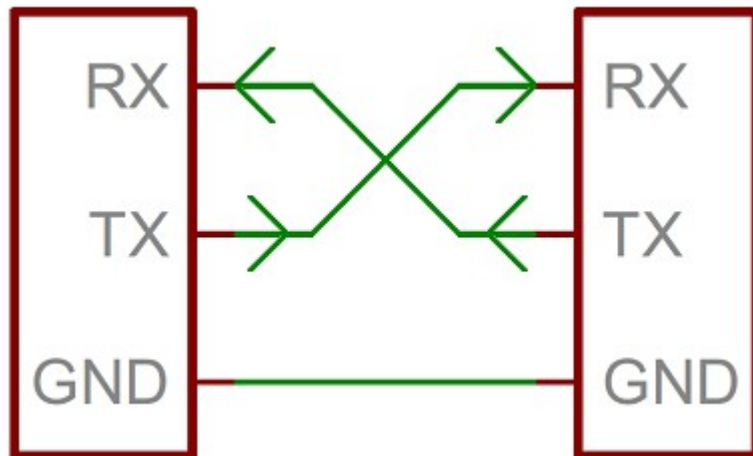
# Comunicacions amb Raspberry Pi

## Connexió amb altre maquinari



**GND**

**TX**  
**RX**

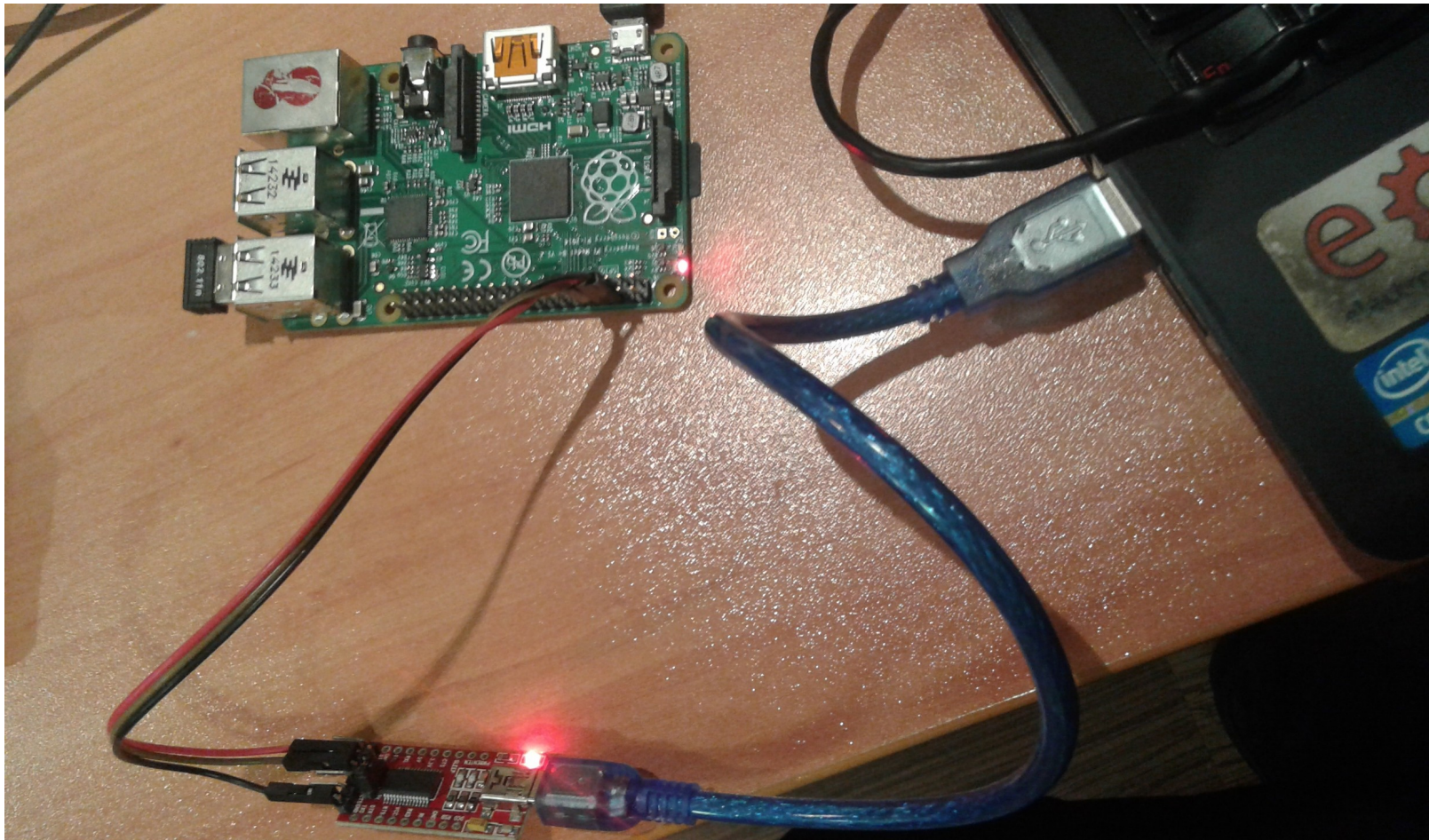






# Comunicacions amb Raspberry Pi

## Connexió amb altre maquinari







# Comunicacions amb Raspberry Pi

## Configuració de xarxa

WiFi : <https://www.raspberrypi.org/documentation/configuration/wireless/wireless-cli.md>

Ethernet : <http://hectorgarciaperez.com/2013/05/01/configurar-interfaces-de-red-en-debian-6/>

### eth0 amb IP estàtica

```
# interfaces(5) file used by ifup(8) and ifdown(8)

# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback

#eth0 amb DHCP
#allow-hotplug eth0
#iface eth0 inet dhcp

#eth0 amb IP estàtica
allow-hotplug eth0
iface eth0 inet static
    address 192.168.1.2
    netmask 255.255.255.0
    network 192.168.1.0
    broadcast 192.168.1.255
    gateway 192.168.1.1
    dns-nameservers 80.58.0.33 80.58.32.97

#WIFI DHCP
allow-hotplug wlan0
iface wlan0 inet dhcp
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
```

### eth0 amb IP dinàmica

```
# interfaces(5) file used by ifup(8) and ifdown(8)

# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback

#eth0 amb DHCP
allow-hotplug eth0
iface eth0 inet dhcp

#eth0 amb IP estàtica
#allow-hotplug eth0
#iface eth0 inet static
#    address 192.168.1.2
#    netmask 255.255.255.0
#    network 192.168.1.0
#    broadcast 192.168.1.255
#    gateway 192.168.1.1
#    dns-nameservers 80.58.0.33 80.58.32.97

#WIFI DHCP
allow-hotplug wlan0
iface wlan0 inet dhcp
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf
```

/etc/network/interfaces



# Comunicacions amb Raspberry Pi

## Configuració de xarxa

Si modifiqueu **wlan0** a `/etc/network/interfaces` i no voleu reiniciar l'equip, executeu:

```
ifdown wlan0  
ifup wlan0
```

Si modifiqueu **eth0** a `/etc/network/interfaces` i no voleu reiniciar l'equip, executeu:

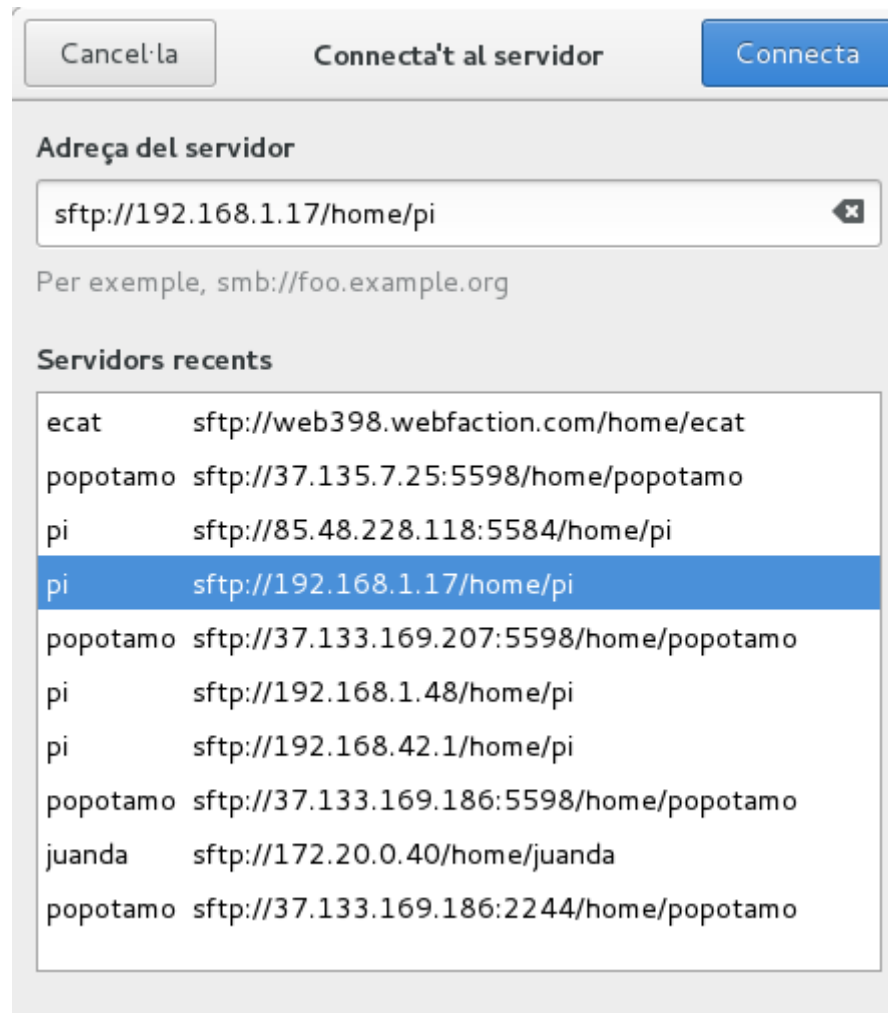
```
ifdown eth0  
ifup eth0
```

`/etc/wpa_supplicant/wpa_supplicant.conf`

```
ctrl_interface=DIR=/var/run/wpa_supplicant GROUP=netdev  
update_config=1  
#country=GB  
  
network={  
    ssid="MOVISTAR_2840"  
    psk="TFTMX3YTUFRC4NAFJUJJ"  
}  
  
network={  
    ssid="Telecos.cat"  
    psk="Fourier17"  
    key_mgmt=WPA-PSK  
}  
  
network={  
    ssid="IoT-eCat"  
    psk="clotClot"  
    key_mgmt=WPA-PSK  
}
```

# Comunicacions amb Raspberry Pi

## Connexió remota emprant el navegador d'arxius





# Comunicacions amb Raspberry Pi

## ifconfig

```
pi@raspberrypi:~ $ ifconfig
eth0      Link encap:Ethernet  HWaddr b8:27:eb:fd:d0:b5
          inet addr:192.168.1.17  Bcast:192.168.1.255  Mask:255.255.255.0
          inet6 addr: fe80::b88e:e7c9:8c24:45d7/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1140 errors:0 dropped:7 overruns:0 frame:0
          TX packets:206 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:77745 (75.9 KiB)  TX bytes:28255 (27.5 KiB)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:65536  Metric:1
          RX packets:226 errors:0 dropped:0 overruns:0 frame:0
          TX packets:226 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1
          RX bytes:20208 (19.7 KiB)  TX bytes:20208 (19.7 KiB)

wlan0     Link encap:Ethernet  HWaddr b8:27:eb:a8:85:e0
          inet addr:192.168.42.1  Bcast:192.168.42.255  Mask:255.255.255.0
          inet6 addr: fe80::4504:2549:cd46:698/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:246 errors:0 dropped:168 overruns:0 frame:0
          TX packets:85 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:39016 (38.1 KiB)  TX bytes:17059 (16.6 KiB)

pi@raspberrypi:~ $ █
```





# Comunicacions amb Raspberry Pi

## Porta d'enllaç i DNS

```
pi@raspberrypi:~ $ route -n
Kernel IP routing table
Destination      Gateway          Genmask          Flags Metric Ref    Use Iface
0.0.0.0          192.168.1.1     0.0.0.0          UG    202    0      0 eth0
169.254.0.0      0.0.0.0         255.255.0.0      U     303    0      0 wlan0
192.168.1.0      0.0.0.0         255.255.255.0    U     202    0      0 eth0
192.168.42.0     0.0.0.0         255.255.255.0    U      0      0      0 wlan0
pi@raspberrypi:~ $ cat /etc/resolv.conf
# Generated by resolvconf
nameserver 62.81.29.254
nameserver 62.81.16.213
pi@raspberrypi:~ $ █
```

# e⚙ Comunicacions amb Raspberry Pi

## SSH

**ssh -X pi@192.168.1.17**

```
jordi@debianJB:~$ ssh -X pi@192.168.1.17
pi@192.168.1.17's password:
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Wed Nov 30 10:09:47 2016 from 192.168.1.12
```

```
pi@raspberrypi:~$ █
```

L'opció -X ens permet poder executar remotament programes amb interfície gràfica d'usuari.

En sistemes operatius Windows existeix el programa putty ( <http://www.putty.org/> )

# e⚙ Comunicacions amb Raspberry Pi

## Accés SSH sense contrasenya

<https://docs.webfaction.com/user-guide/access.html>

**Genereu una clau al vostre ordinador** (si no existeix `~/.ssh/id_rsa.pub`):

- 1- Obriu una sessió de terminal.
- 2- Creeu la carpeta `~/.ssh`, en cas de que no existeixi. (`mkdir -p $HOME/.ssh`)
- 3- Aneu al directori `~/.ssh` (`cd ~/.ssh` i premeu Enter)
- 4- Genereu les vostres claus (`ssh-keygen -t rsa`)
- 5- Premeu Enter per a contestar totes les preguntes per defecte.

### Desplegueu la clau a la Raspberry Pi

- 1- Copieu la clau a la Raspberry Pi. Entreu `scp ~/.ssh/id_rsa.pub pi@192.168.1.17:temp_id_rsa_key.pub` (canvieu 192.168.1.17 per la IP de la vostra Raspberry Pi) i premeu Enter.
- Entreu la contrasenya quan us ho demani (la contrasenya per defecte és raspberry).

```
jordi@debianJB:~$ scp ~/.ssh/id_rsa.pub pi@192.168.1.17:temp_id_rsa_key.pub
pi@192.168.1.17's password:
id_rsa.pub                                100% 396      0.4KB/s   00:00
jordi@debianJB:~$ █
```

# Comunicacions amb Raspberry Pi

## Accés SSH sense contrasenya

### Desplegueu la clau a la Raspberry Pi

2- Obriu una sessió SSH a la vostra Raspberry Pi des del vostre ordinador. Entreu **ssh pi@192.168.1.17** (canvieu 192.168.1.17 per la IP de la vostra Raspberry Pi) i premeu Enter. Entreu la contrasenya quan us ho demani (la contrasenya per defecte és **raspberrypi**).

```
jordi@debianJB:~$ ssh pi@192.168.1.17
pi@192.168.1.17's password:
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Wed Nov 30 10:18:28 2016 from 192.168.1.12
```

```
pi@raspberrypi:~$ █
```

3- Creeu la carpeta `~/ .ssh`, en cas de que no existeixi. (`mkdir -p $HOME/.ssh` )

4- Afegiu la vostra clau a l'arxiu `authorized_keys` . Entreu `cat ~/temp_id_rsa_key.pub >> ~/.ssh/authorized_keys` i premeu Enter.

```
pi@raspberrypi:~$ cat ~/temp_id_rsa_key.pub >> ~/.ssh/authorized_keys
```



# e⚙️ Comunicacions amb Raspberry Pi

## Accés SSH sense contrasenya

### Desplegueu la clau a la Raspberry Pi

5- Esborreu l'arxiu amb la clau temporal. Feu `rm temp_id_rsa_key.pub` i premeu Enter.

```
pi@raspberrypi:~ $ rm temp_id_rsa_key.pub
```

6- Protegiu l'arxiu de claus SSH. Entreu-hi `chmod 600 ~/.ssh/authorized_keys` i premeu Enter.

```
pi@raspberrypi:~ $ chmod 600 ~/.ssh/authorized keys
```

7- Protegiu el directori SSH. Entreu-hi `chmod 700 ~/.ssh` i premeu Enter.

```
pi@raspberrypi:~ $ chmod 700 ~/.ssh
```

8- Protegiu el vostre directori d'usuari. Entreu-hi `chmod go-w $HOME` i premeu Enter.

```
pi@raspberrypi:~ $ chmod go-w $HOME
```

9- Tanqueu la sessió SSH.

# e⚙️ Comunicacions amb Raspberry Pi

## Accés SSH sense contrasenya

**Desplegueu la clau a la Raspberry Pi**

```
pi@raspberrypi:~ $ cat ~/temp_id_rsa_key.pub >> ~/.ssh/authorized_keys
pi@raspberrypi:~ $ rm temp_id_rsa_key.pub
pi@raspberrypi:~ $ chmod 600 ~/.ssh/authorized_keys
pi@raspberrypi:~ $ chmod 700 ~/.ssh
pi@raspberrypi:~ $ chmod go-w $HOME
pi@raspberrypi:~ $ exit
logout
Connection to 192.168.1.17 closed.
jordi@debianJB:~$
```

**Verifiqueu que ja podeu accedir mitjançant SSH sense que us preguntí la contrasenya**

```
jordi@debianJB:~$ ssh pi@192.168.1.17

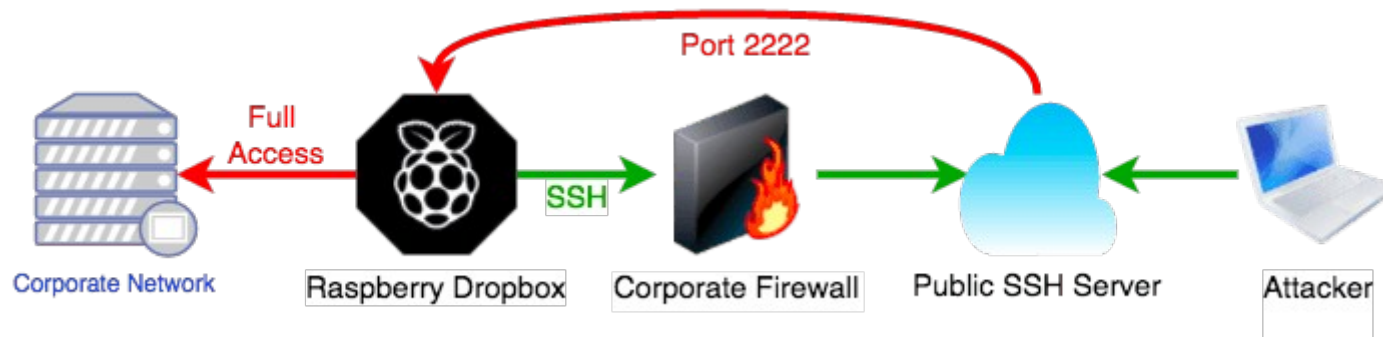
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Nov 30 11:03:54 2016 from 192.168.1.12
pi@raspberrypi:~ $
```

# e⚙ Comunicacions amb Raspberry Pi

## Túnel SSH invers

<http://jerrygamblin.com/2016/04/23/persistent-reverse-ssh-tunnels-on-a-raspberrypi/>



# Comunicacions amb Raspberry Pi

## Túnel SSH invers

```
jordi@debianJB: ~
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda

pi@raspberrypi:~ $ ssh -R 12345:localhost:22 jordi@192.168.1.12
The authenticity of host '192.168.1.12 (192.168.1.12)' can't be established.
ECDSA key fingerprint is 01:eb:89:96:25:8b:48:22:e9:a7:ed:5e:d4:98:c4:ac.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '192.168.1.12' (ECDSA) to the list of known hosts.
jordi@192.168.1.12's password:

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
jordi@debianJB:~$
```

```
pi@raspberrypi: ~
Fitxer  Edita  Visualitza  Cerca  Terminal  Ajuda

jordi@debianJB:~$ ssh -p 12345 pi@127.0.0.1
The authenticity of host '[127.0.0.1]:12345 ([127.0.0.1]:12345)' can't be established.
ECDSA key fingerprint is db:79:95:3e:5d:97:96:cd:ce:57:64:96:63:82:15:e2.
Are you sure you want to continue connecting (yes/no)? yes
Warning: Permanently added '[127.0.0.1]:12345' (ECDSA) to the list of known hosts.

The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
Last login: Wed Nov 30 23:46:52 2016 from 192.168.1.12
pi@raspberrypi:~ $
```



# Comunicacions amb Raspberry Pi

## autoSSH

Si el túnel deixa de funcionar (acostuma a ocórrer en xarxes molt ocupades o d'escasa qualitat, com el 3G), es pot utilitzar el paquet autossh en lloc de l'ssh per a establir la connexió que s'encarregarà de mantenir el túnel obert reiniciant automàticament la connexió.

```
pi@raspberrypi:~ $ autossh -M 65500 -o ServerAliveInterval=20 -R 19994:localhost:22 ecat@web398.webfaction.com
```

L'autossh no funciona com s'espera si al connectar la Raspberry Pi no hi ha connexió a Internet. Per a evitar això, primer verifiquem la connectivitat fent un ping.

```
jordi@debianJB:~$ ssh ecat@web398.webfaction.com
ecat@web398.webfaction.com's password:
Last login: Wed Nov 30 23:21:27 2016 from 62.83.215.143
[ecat@web398 ~]$ ssh -p 19994 pi@localhost
pi@localhost's password:
```

```
The programs included with the Debian GNU/Linux system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
```

```
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent
permitted by applicable law.
```

```
Last login: Thu Dec  1 00:24:02 2016 from localhost
```

```
pi@raspberrypi:~ $ █
```



# Comunicacions amb Raspberry Pi

## Verificació de la connectivitat

```
pi@raspberrypi:~ $ ping -c 1 www.binefa.cat
PING binefa.cat (37.58.75.228) 56(84) bytes of data.
64 bytes from web398.webfaction.com (37.58.75.228): icmp_seq=1 ttl=52 time=49.2 ms

--- binefa.cat ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 49.200/49.200/49.200/0.000 ms
pi@raspberrypi:~ $ echo $?
0
pi@raspberrypi:~ $ ping -c 1 www.jordibinefa.cat
ping: unknown host www.jordibinefa.cat
pi@raspberrypi:~ $ echo $?
2
pi@raspberrypi:~ $ ping -c 1 192.168.1.222
PING 192.168.1.222 (192.168.1.222) 56(84) bytes of data.
From 192.168.1.17 icmp_seq=1 Destination Host Unreachable

--- 192.168.1.222 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

pi@raspberrypi:~ $ echo $?
1
pi@raspberrypi:~ $ ping -c 1 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=1.01 ms

--- 192.168.1.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.019/1.019/1.019/0.000 ms
pi@raspberrypi:~ $ echo $?
0
pi@raspberrypi:~ $ █
```



# Comunicacions amb Raspberry Pi

## Ordres consecutives emprant &&

```

pi@raspberrypi:~ $ ping -c 1 192.168.1.222 && ls
PING 192.168.1.222 (192.168.1.222) 56(84) bytes of data.
From 192.168.1.17 icmp_seq=1 Destination Host Unreachable

--- 192.168.1.222 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

pi@raspberrypi:~ $ ping -c 1 192.168.1.1 && ls
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=1.01 ms

--- 192.168.1.1 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.019/1.019/1.019/0.000 ms
codis      Documents Music      Pictures  pwdVnc.txt  sketchbook  tunelSSH.txt
Desktop  Downloads oldconffiles Public    python_games Templates  Videos
pi@raspberrypi:~ $ ping -c 1 www.jordibinefa.cat && ls
ping: unknown host www.jordibinefa.cat
pi@raspberrypi:~ $ ping -c 1 www.binefa.cat && ls
PING binefa.cat (37.58.75.228) 56(84) bytes of data.
64 bytes from web398.webfaction.com (37.58.75.228): icmp_seq=1 ttl=52 time=48.6 ms

--- binefa.cat ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 48.642/48.642/48.642/0.000 ms
codis      Documents Music      Pictures  pwdVnc.txt  sketchbook  tunelSSH.txt
Desktop  Downloads oldconffiles Public    python_games Templates  Videos
pi@raspberrypi:~ $ █

```

En cas de que la primera ordre tingui èxit, llavors executa la següent.



# Comunicacions amb Raspberry Pi

## Processos actius i grep

```

pi@raspberrypi:~ $ ps aux | grep autossh
pi          2586  0.0  0.2  4772  2032 pts/0    S+   12:18   0:00 grep --color=auto autossh
pi@raspberrypi:~ $ ps aux | grep autossh | grep -v grep
pi@raspberrypi:~ $ if ! ps aux | grep autossh > /dev/null; then echo "No hi ha cap procés"; else echo "Hi ha algun procés"; fi
Hi ha algun procés
pi@raspberrypi:~ $ if ! ps aux | grep autossh | grep -v grep > /dev/null; then echo "No hi ha cap procés"; else echo "Hi ha algun pro
cés"; fi
No hi ha cap procés
pi@raspberrypi:~ $ if ! ps aux | grep autossh > /dev/null; then echo "No hi ha cap procés"; fi
pi@raspberrypi:~ $ if ! ps aux | grep autossh | grep -v grep > /dev/null; then echo "No hi ha cap procés"; fi
No hi ha cap procés
pi@raspberrypi:~ $ █

```





# Comunicacions amb Raspberry Pi

## crontab

/etc/crontab

```
# /etc/crontab: system-wide crontab
# Unlike any other crontab you don't have to run the `crontab'
# command to install the new version when you edit this file
# and files in /etc/cron.d. These files also have username fields,
# that none of the other crontabs do.

SHELL=/bin/sh
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin:/usr/sbin:/usr/bin

# m h dom mon dow user  command
17 * * * * root    cd / && run-parts --report /etc/cron.hourly
25 6 * * * root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.daily )
47 6 * * 7 root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.weekly )
52 6 1 * * root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.monthly )
*/1 * * * * root    ping -c 1 www.binefa.cat && if ! ps aux | grep autossh | grep -v grep > /dev/nl
#
```

```
*/1 * * * * root    ping -c 1 www.binefa.cat
&& if ! ps aux | grep autossh | grep -v grep >
/dev/null; then su pi -c 'autossh -f -nNT -M 65500
-o ServerAliveInterval=20 -R 19994:localhost:22
ecat@web398.webfaction.com'; fi
```



# Comunicacions amb Raspberry Pi

## Persistència de les accions remotes screen (1/2)

<http://www.tecmint.com/screen-command-examples-to-manage-linux-terminals/>

```
pi@raspberrypi:~ $ screen -ls
No Sockets found in /var/run/screen/S-pi.
```

```
pi@raspberrypi:~ $ screen
```

```
pi@raspberrypi:~ $ ping 192.168.1.1
PING 192.168.1.1 (192.168.1.1) 56(84) bytes of data.
64 bytes from 192.168.1.1: icmp_seq=1 ttl=64 time=2.07 ms
64 bytes from 192.168.1.1: icmp_seq=2 ttl=64 time=0.919 ms
64 bytes from 192.168.1.1: icmp_seq=3 ttl=64 time=1.17 ms
64 bytes from 192.168.1.1: icmp_seq=4 ttl=64 time=0.960 ms
64 bytes from 192.168.1.1: icmp_seq=5 ttl=64 time=0.934 ms
64 bytes from 192.168.1.1: icmp_seq=6 ttl=64 time=1.33 ms
```

Per a sortir temporalment d'screen premeu **Ctrl A + D**

```
[detached from 2427.pts-0.raspberrypi]
pi@raspberrypi:~ $
```

# Comunicacions amb Raspberry Pi

## Persistència de les accions remotes

### screen (2/2)

<http://www.tecmint.com/screen-command-examples-to-manage-linux-terminals/>

```
[detached from 2427.pts-0.raspberrypi]
pi@raspberrypi:~ $ exit
logout
Connection to 192.168.1.17 closed.
jordi@debianJB:~$ ssh pi@192.168.1.17
```

The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/\*/copyright.

Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.

Last login: Wed Nov 30 11:55:07 2016 from 192.168.1.12

```
pi@raspberrypi:~ $ screen -r
```

```
64 bytes from 192.168.1.1: icmp_seq=205 ttl=64 time=0.883 ms
64 bytes from 192.168.1.1: icmp_seq=206 ttl=64 time=0.881 ms
64 bytes from 192.168.1.1: icmp_seq=207 ttl=64 time=0.969 ms
64 bytes from 192.168.1.1: icmp_seq=208 ttl=64 time=0.873 ms
64 bytes from 192.168.1.1: icmp_seq=209 ttl=64 time=1.10 ms
64 bytes from 192.168.1.1: icmp_seq=210 ttl=64 time=0.927 ms
64 bytes from 192.168.1.1: icmp_seq=211 ttl=64 time=0.906 ms
64 bytes from 192.168.1.1: icmp_seq=212 ttl=64 time=0.860 ms
```

```
[screen is terminating]
pi@raspberrypi:~ $
```

Per a cancel·lar el ping podem prémer Ctrl C i per a sortir de screen fem exit





# Comunicacions amb Raspberry Pi

## Publicació de la IP pública (1/2)

← ⓘ | binefa.cat/php/svr/

37.133.169.186

dc nov 30 13:00:02 CET 2016

```
popotamo@popotamo:~$ cat /etc/crontab
# /etc/crontab: system-wide crontab
# Unlike any other crontab you don't have to run the `crontab'
# command to install the new version when you edit this file
# and files in /etc/cron.d. These files also have username fields,
# that none of the other crontabs do.

SHELL=/bin/sh
PATH=/usr/local/sbin:/usr/local/bin:/sbin:/bin:/usr/sbin:/usr/bin

# m h dom mon dow user  command
17 * * * * root    cd / && run-parts --report /etc/cron.hourly
25 6 * * * root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.daily )
47 6 * * 7 root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.weekly )
52 6 1 * * root    test -x /usr/sbin/anacron || ( cd / && run-parts --report /etc/cron.monthly )
#
*/5 * * * * popotamo /home/popotamo/bin/svr.sh
#
*/1 * * * * popotamo /home/popotamo/bin/checkAutoSSH.sh
popotamo@popotamo:~$ █
```



# Comunicacions amb Raspberry Pi

## Publicació de la IP pública (2/2)

```
popotamo@popotamo:~$ cat /home/popotamo/bin/svr.sh
#!/bin/bash
```

```
# rm ip.php
wget http://www.binefa.cat/php/ip/ip.php
echo "<BR>" >> ip.php
date >> ip.php
```

```
scp ip.php ecat@web398.webfaction.com:/home/ecat/webapps/www_binefa_cat_php/svr/index.php
```

```
rm ip.php
popotamo@popotamo:~$ █
```

```
< ui_ctrlLeds01.py x ecat.cpp x index.htm x index.php x
1 <META HTTP-EQUIV="refresh" CONTENT="0;URL=ip.php">
2
```

```
ecat.cpp x index.htm x index.php x ip.php x >
1 <?php
2 echo $_SERVER['REMOTE_ADDR'];
3 ?>
4
```

```
ecat.cpp x index.htm x index.php x ip.php x
1 <HTML>
2 <HEAD>
3 <TITLE>Your Internet IP</TITLE>
4 </HEAD>
5 <BODY>
6 <?php
7 echo $_SERVER['REMOTE_ADDR'];
8 ?>
9 </BODY>
10 </HTML>
11
```



# Comunicacions amb Raspberry Pi

## Raspberry Pi com a punt d'accés (1/4)

<http://elinux.org/RPI-Wireless-Hotspot>

Instal·lació de paquets:

**sudo apt-get install hostapd udhcpd**

```
pi@raspberrypi:~ $ cat /etc/udhcpd.conf
# Sample udhcpd configuration file (/etc/udhcpd.conf)

# The start and end of the IP lease block

start          192.168.42.20    #default: 192.168.0.20
end            192.168.42.254   #default: 192.168.0.254

# The interface that udhcpd will use

interface      wlan0           #default: eth0

#Examples
#opt    dns      192.168.10.2 192.168.10.10
opt     dns      8.8.8.8 4.2.2.2
option  subnet   255.255.255.0
#opt    router   192.168.10.2
opt     router   192.168.42.1
#opt    wins     192.168.10.10
#option dns      129.219.13.81  # appened to above DNS servers for a total of 3
#option domain   local
option  lease     864000        # 10 days of seconds
```





# Comunicacions amb Raspberry Pi

## Raspberry Pi com a punt d'accés (2/4)

```
pi@raspberrypi:~ $ cat /etc/default/udhcpd
# Comment the following line to enable
#DHCPD_ENABLED="no"

# Options to pass to busybox' udhcpd.
#
# -S    Log to syslog
# -f    run in foreground

DHCPD_OPTS="-S"
pi@raspberrypi:~ $ █
```

```
pi@raspberrypi:~ $ cat /etc/network/interfaces
# interfaces(5) file used by ifup(8) and ifdown(8)

# Please note that this file is written to be used with dhcpcd
# For static IP, consult /etc/dhcpcd.conf and 'man dhcpcd.conf'

# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d

auto lo
iface lo inet loopback

iface eth0 inet manual

allow-hotplug wlan0
#iface wlan0 inet manual
#    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf

iface wlan0 inet static
    address 192.168.42.1
    netmask 255.255.255.0

allow-hotplug wlan1
iface wlan1 inet manual
    wpa-conf /etc/wpa_supplicant/wpa_supplicant.conf

up iptables-restore < /etc/iptables.ipv4.nat
```



# Comunicacions amb Raspberry Pi

## Raspberry Pi com a punt d'accés (3/4)

```
pi@raspberrypi:~ $ cat /etc/hostapd/hostapd.conf
```

```
interface=wlan0
driver=nl80211
ssid=pvSL
hw_mode=g
channel=10
macaddr_acl=0
auth_algs=1
ignore_broadcast_ssid=0
wpa=2
wpa_passphrase=fanalBolet0
wpa_key_mgmt=WPA-PSK
#wpa_pairwise=TKIP           # You better do not use this weak encryption (only used by old client devices)
rsn_pairwise=CCMP
ieee80211n=1                 # 802.11n support
wmm_enabled=1               # QoS support
ht_capab=[HT40][SHORT-GI-20][DSSS_CCK-40]
pi@raspberrypi:~ $ █
```

```
pi@raspberrypi:~ $ cat /etc/default/hostapd
```

```
# Defaults for hostapd initscript
#
# See /usr/share/doc/hostapd/README.Debian for information about
# methods of managing hostapd.
#
# Uncomment and set DAEMON_CONF to the absolute path of a hostap
# file and hostapd will be started during system boot. An exampl
# file can be found at /usr/share/doc/hostapd/examples/hostapd.c
#
DAEMON_CONF="/etc/hostapd/hostapd.conf"

# Additional daemon options to be appended to hostapd command:-
#       -d      show more debug messages (-dd for even more)
#       -K      include key data in debug messages
#       -t      include timestamps in some debug messages
#
# Note that -B (daemon mode) and -P (pidfile) options are automa
# configured by the init.d script and must not be added to DAEMC
#
#DAEMON_OPTS=""
pi@raspberrypi:~ $ █
```



# Comunicacions amb Raspberry Pi

## Raspberry Pi com a punt d'accés (4/4)

A l'arxiu /etc/sysctl.conf

```
# Uncomment the next line to enable packet forwarding for IPv4
net.ipv4.ip_forward=1
```

```
pi@raspberrypi:~ $ cat /etc/iptables.ipv4.nat
# Generated by iptables-save v1.4.21 on Sat Oct  8 22:18:23 2016
*filter
:INPUT ACCEPT [36:2032]
:FORWARD ACCEPT [0:0]
:OUTPUT ACCEPT [41:6275]
-A FORWARD -i eth0 -o wlan0 -m state --state RELATED,ESTABLISHED -j ACCEPT
-A FORWARD -i wlan0 -o eth0 -j ACCEPT
COMMIT
# Completed on Sat Oct  8 22:18:23 2016
# Generated by iptables-save v1.4.21 on Sat Oct  8 22:18:23 2016
*nat
:PREROUTING ACCEPT [0:0]
:INPUT ACCEPT [0:0]
:OUTPUT ACCEPT [0:0]
:POSTROUTING ACCEPT [0:0]
-A POSTROUTING -o eth0 -j MASQUERADE
COMMIT
# Completed on Sat Oct  8 22:18:23 2016
pi@raspberrypi:~ $ █
```

Per a reiniciar els serveis:

```
sudo update-rc.d hostapd enable
sudo update-rc.d udhcpd enable
```



# Comunicacions amb Raspberry Pi

## Configuració de la Raspberry Pi

```
pi@raspberrypi ~ $ sudo raspi-config
```

### Raspberry Pi Software Configuration Tool (raspi-config)

- |                                  |   |
|----------------------------------|---|
| 1 Expand Filesystem              | Ensures that all of the SD card storage is available to the OS                  |
| 2 Change User Password           | Change password for the default user (pi)                                       |
| 3 Enable Boot to Desktop/Scratch | Choose whether to boot into a desktop environment, Scratch, or the command-line |
| 4 Internationalisation Options   | Set up language and regional settings to match your location                    |
| 5 Enable Camera                  | Enable this Pi to work with the Raspberry Pi Camera                             |
| 6 Add to Rastrack                | Add this Pi to the online Raspberry Pi Map (Rastrack)                           |
| 7 Overclock                      | Configure overclocking for your Pi  |
| 8 Advanced Options               | Configure advanced settings   |
| 9 About raspi-config             | Information about this configuration tool                                       |

<Select>

<Finish>

Chose boot option

Console Text console, requiring login (default)

Desktop Log in as user 'pi' at the graphical desktop

Scratch Start the Scratch programming environment upon boot

<Ok>

<Cancel>

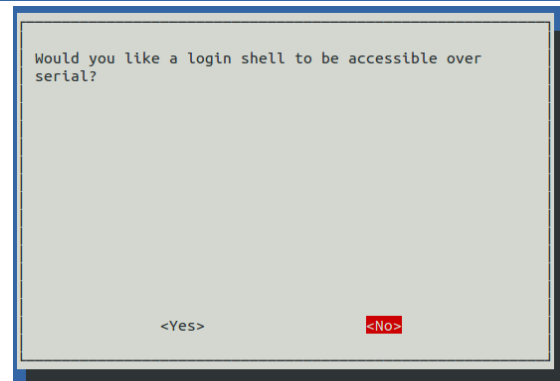
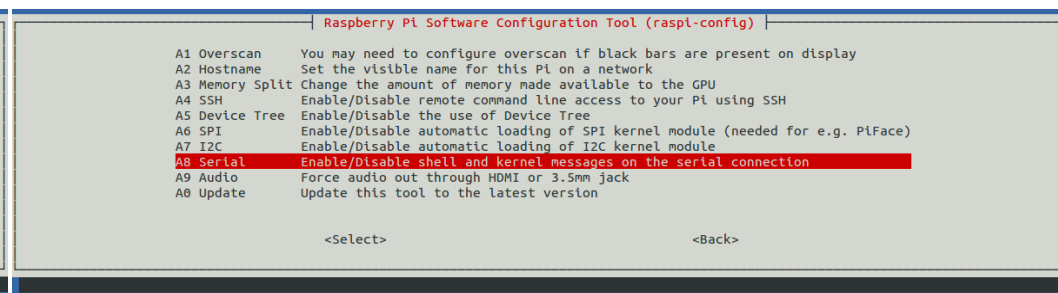
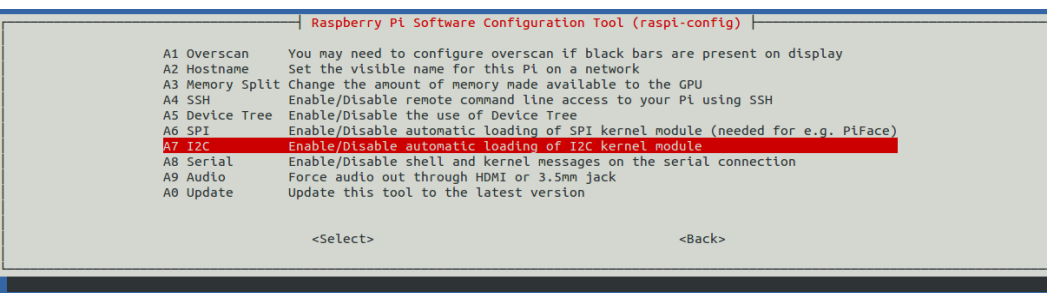
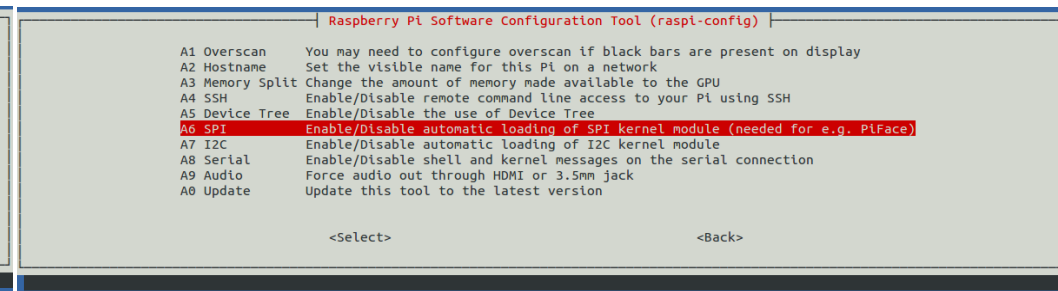
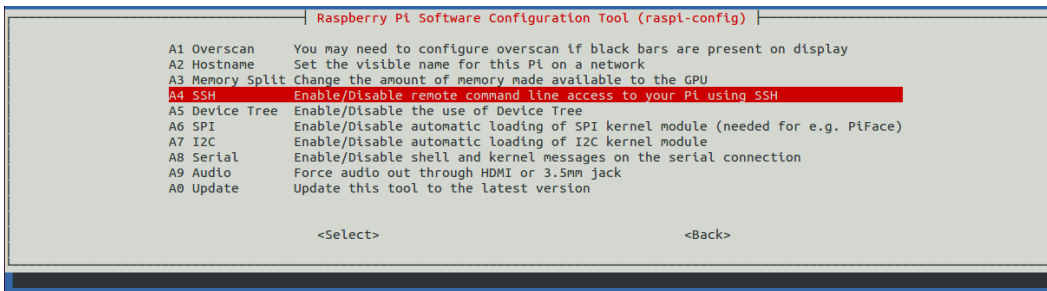




# Comunicacions amb Raspberry Pi

## Configuració de la Raspberry Pi

```
pi@raspberrypi ~ $ sudo raspi-config
```



Configuració del port sèrie per a versions més antigues de Raspbian :

<http://electronics.cat/doc/3Bpi/rs232/setRs232up.html>



# Comunicacions amb Raspberry Pi

## Accés remot mitjançant SSH

```
jordi@eCat: ~  
jordi@eCat:~$ ssh pi@192.168.1.37  
pi@192.168.1.37's password: 
```

```
jordi@eCat:~$ ssh pi@192.168.1.37  
pi@192.168.1.37's password:  
Linux raspberrypi 3.18.7+ #755 PREEMPT Thu Feb 12 17:14:31 GMT 2015 armv6l  
  
The programs included with the Debian GNU/Linux system are free software;  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Wed Apr  8 13:03:17 2015 from 192.168.1.5  
pi@raspberrypi ~ $
```

Per accedir amb opció d'executar remotament programes amb interfície gràfica (GUI) :

```
ssh -X pi@192.168.1.37
```



# Comunicacions amb Raspberry Pi

## Configuració de l'I2C

```
pi@raspberrypi ~ $ sudo nano /etc/modules
```

```
pi@raspberrypi ~ $ sudo nano /etc/modules
pi@raspberrypi ~ $ cat /etc/modprobe.d/raspi-blacklist.conf
pi@raspberrypi ~ $
```

```
pi@raspberrypi ~ $ cat /etc/modules
# /etc/modules: kernel modules to load at boot time.
#
# This file contains the names of kernel modules that should be
# at boot time, one per line. Lines beginning with "#" are ignored.
# Parameters can be specified after the module name.

snd-bcm2835
i2c-bcm2708
i2c-dev
```

```
pi@raspberrypi ~ $ uname -a
Linux raspberrypi 3.18.7+ #755 PREEMPT Thu Feb 12 17:14:31 GMT
pi@raspberrypi ~ $ tail /boot/config.txt
#config_hdmi_boost=4
```

```
# uncomment for composite PAL
#sdtv_mode=2
```

```
#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800
```

```
dtparam=spi=on
dtparam=i2c_arm=on
pi@raspberrypi ~ $
```

```
pi@raspberrypi ~ $ tail /boot/config.txt
#config_hdmi_boost=4
```

```
# uncomment for composite PAL
#sdtv_mode=2
```

```
#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800
```

```
dtparam=spi=on
```

```
dtparam=i2c_arm=on
```

```
pi@raspberrypi ~ $ sudo nano /boot/config.txt
```

```
pi@raspberrypi ~ $ tail /boot/config.txt
```

```
# uncomment for composite PAL
#sdtv_mode=2
```

```
#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800
```

```
dtparam=spi=on
```

```
dtparam=i2c1=on
```

```
dtparam=i2c_arm=on
```

```
pi@raspberrypi ~ $
```



# Comunicacions amb Raspberry Pi

## Configuració de l'I2C

```
pi@raspberrypi ~ $ sudo aptitude install i2c-tools python-smbus
```

```
pi@raspberrypi:~ $ sudo i2cdetect -y 1
```

|     | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | a  | b  | c  | d  | e  | f  |
|-----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 00: |    |    |    | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 10: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 20: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 30: | -- | -- | -- | -- | -- | -- | -- | -- | 38 | 39 | -- | -- | -- | -- | -- | -- |
| 40: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 50: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 60: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 70: | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |

```
pi@raspberrypi:~ $
```

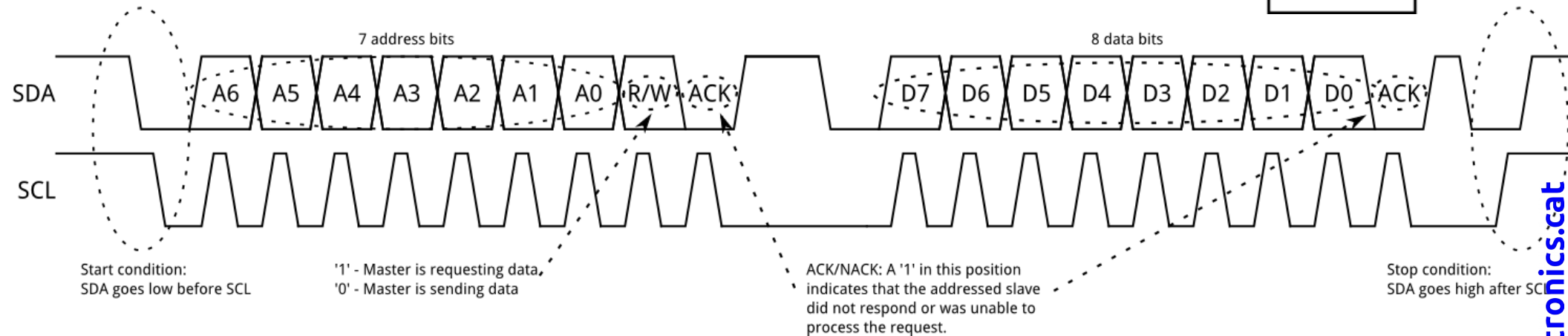
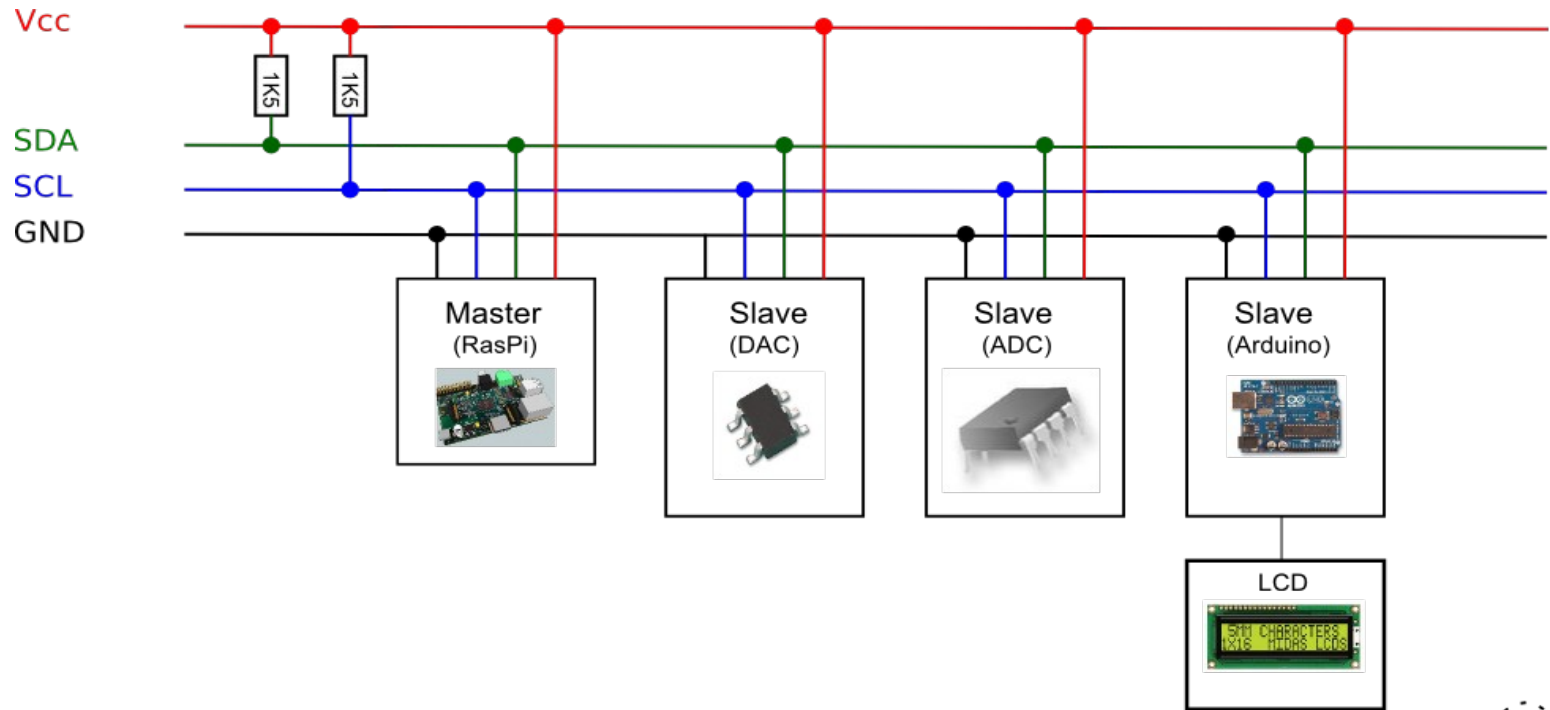
```
sudo i2cset -y 1 0x38 0xA5
sudo i2cset -y 1 0x39 0xF0
sudo i2cset -y 1 0x39 0xF
```





# Comunicacions amb Raspberry Pi

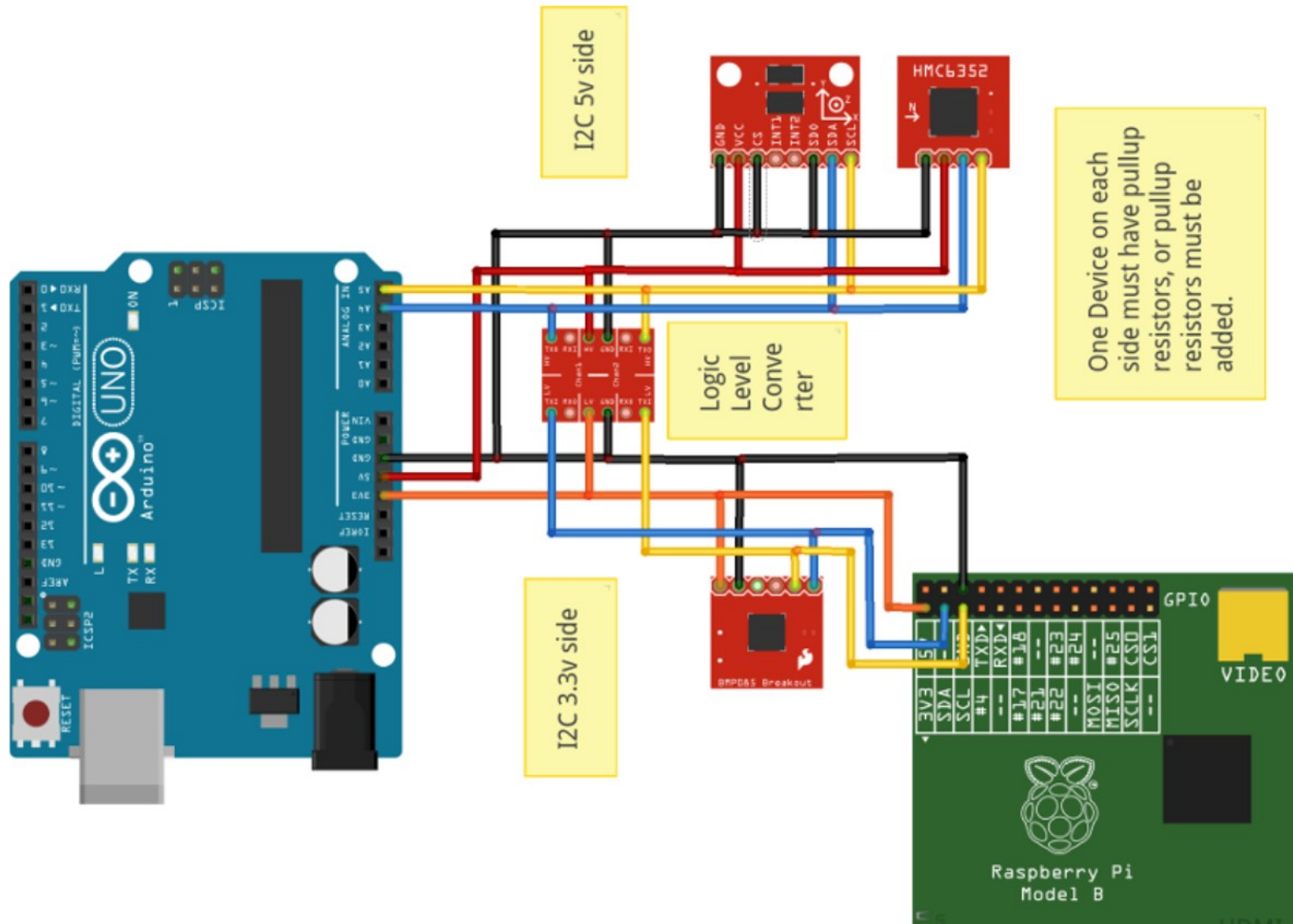
## I2C





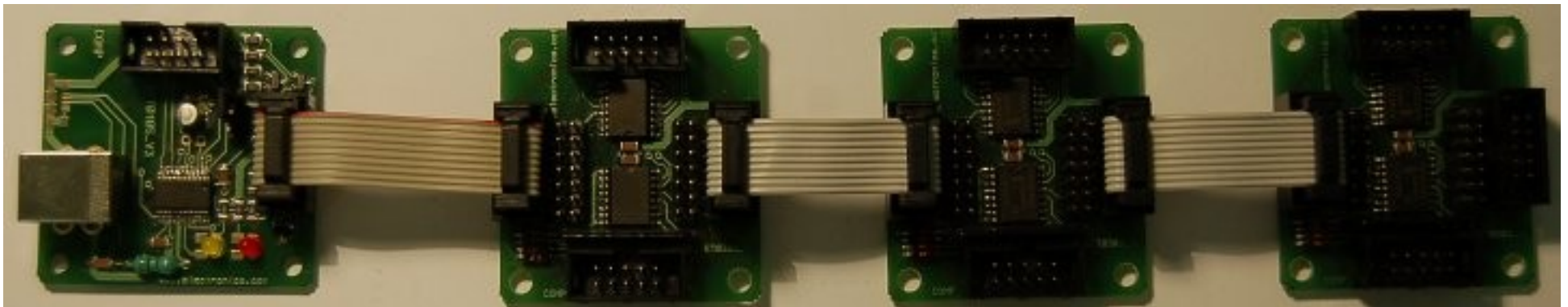
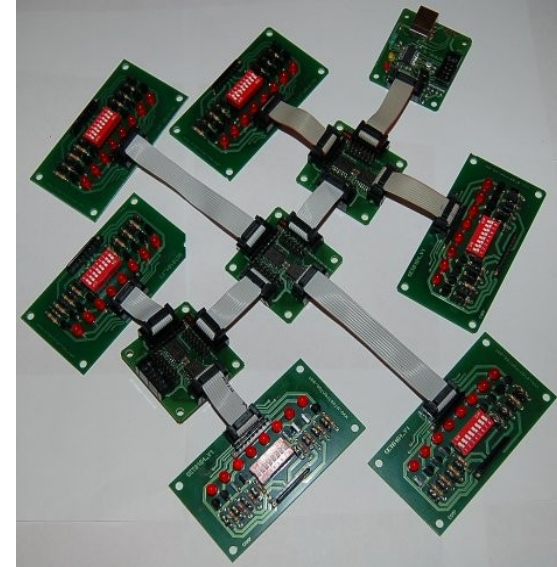
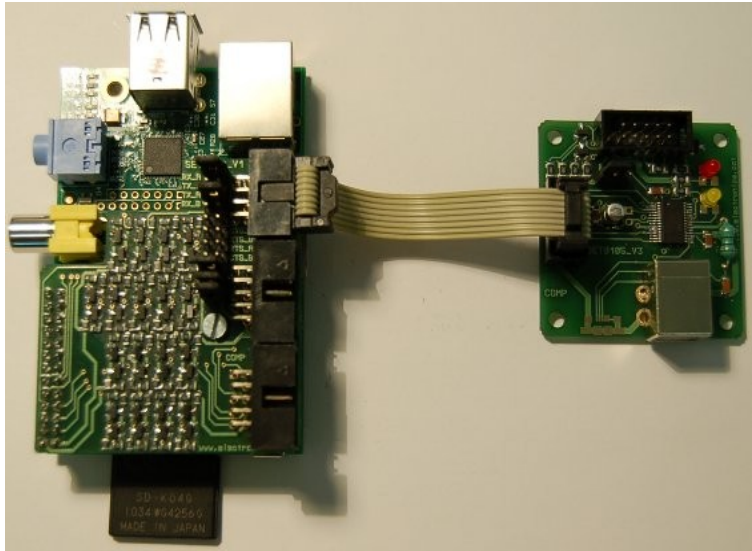
# Comunicacions amb Raspberry Pi

## I2C



# Comunicacions amb Raspberry Pi

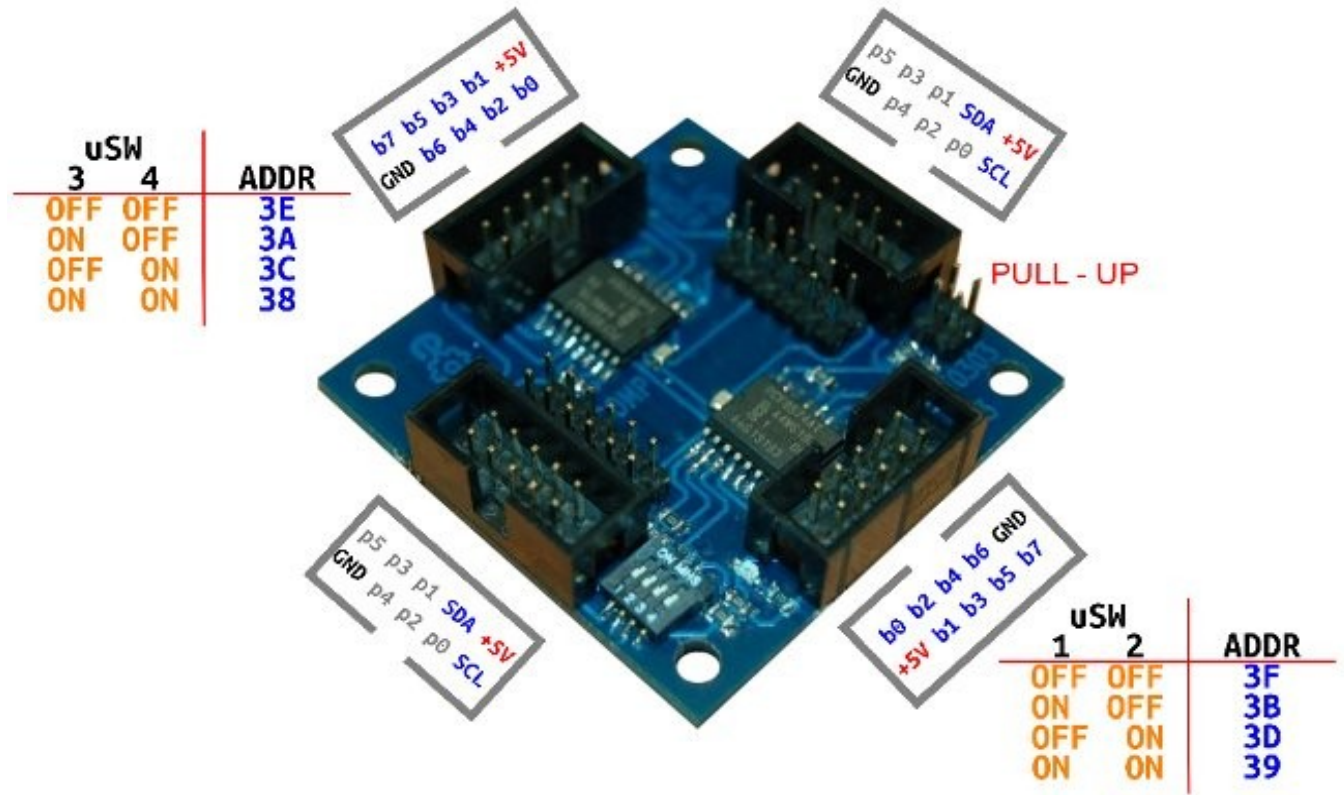
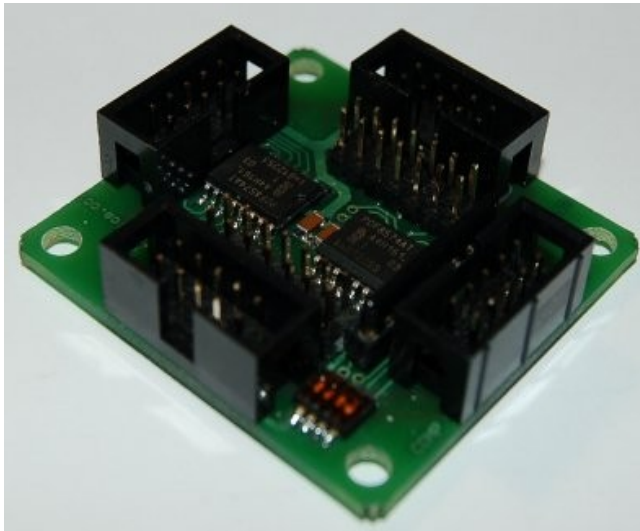
## I2C





# Comunicacions amb Raspberry Pi

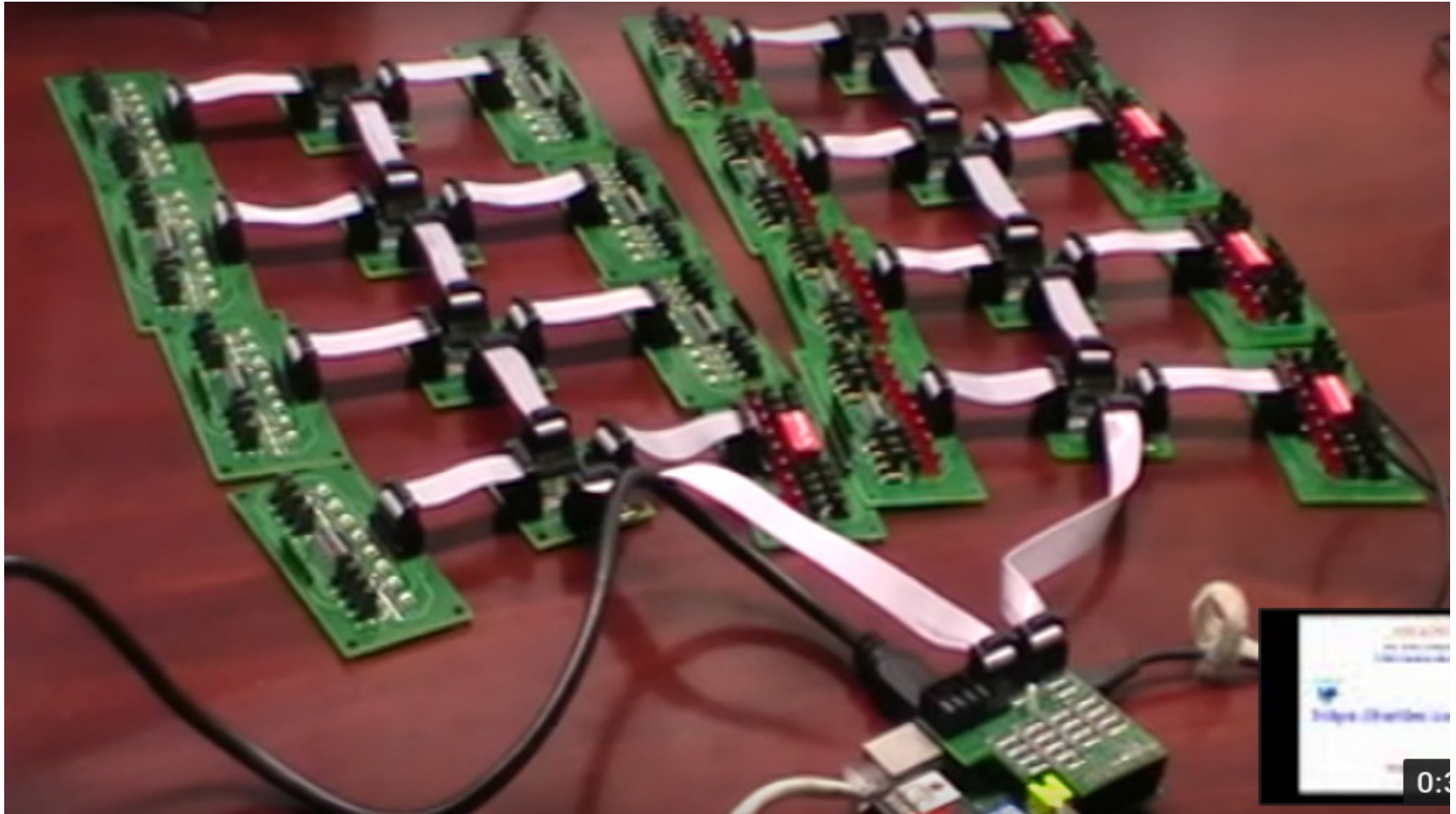
## I2C





# e⚙ Comunicacions amb Raspberry Pi

## I2C



<http://electronics.cat/php/common/index.php?lang=ca&page=508>



# Arduino i Raspberry Pi

## Instal·lació de més programes

Instal·leu biblioteques complementàries per a interactuar amb Python, l'IDE d'Arduino i les biblioteques complementàries d'electronics.cat :

```
pi@raspberrypi ~ $ sudo aptitude install python-dev python-rpi.gpio python-serial  
python-netifaces python-pip
```

```
pi@raspberrypi ~ $ sudo pip install pyfirmata
```

```
pi@raspberrypi ~/downloads $ sudo aptitude install arduino
```

```
pi@raspberrypi ~/downloads $ wget http://www.electronics.cat/doc/arduinoLib/ecat.zip
```

Descomprimiu ecat.zip i moveu la carpeta ecat generada a la carpeta de biblioteques d'Arduino

```
pi@raspberrypi ~/downloads $ sudo mv ecat /usr/share/arduino/libraries
```

Descarregueu el paquet de l'Scratch For Arduino a la carpeta /home/pi/downloads i instal·leu-lo

```
pi@raspberrypi ~ $ cd downloads/  
pi@raspberrypi ~/downloads $ sudo dpkg -i S4A15_RP.deb
```



# Comunicacions amb Raspberry Pi

## Configuració de l'accés sèrie

Instal·lació del minicom, programa de comunicacions amb el port sèrie :

```
pi@raspberrypi ~ $ sudo aptitude install minicom
```

Assignació de permisos a l'usuari normal (més enllà del primari o root) :

```
pi@raspberrypi ~ $ sudo usermod -a -G dialout pi
```

(Cal que sortiu i torneu a entrar a la sessió per a que els permisos siguin efectius)

Execució del minicom pel terminal :

```
minicom -b 9600 -o -D /dev/ttyAMA0
```

```
minicom -b 9600 -o -D /dev/ttyUSB0
```

Per a sortir del minicom :

Prémer les tecles 'Ctrl' i 'A' simulatàniament i sense deixar anar, prémer 'Z',  
després l'opció 'X' i seleccionar 'Yes'



# Comunicacions amb Raspberry Pi

## Imatge de la Raspberry Pi descarregable

Us podeu descarregar la imatge ja preparada de la Raspberry prement sobre la icona o sobre l'enllaç :



[https://mega.co.nz/#!1xFVEJKK!zear\\_LuHkAKryys4D\\_wsj8\\_jehya\\_7MZ1Ath84BF--4](https://mega.co.nz/#!1xFVEJKK!zear_LuHkAKryys4D_wsj8_jehya_7MZ1Ath84BF--4)

L'arxiu descarregat és **raspbianEcat00.img.zip** i ocupa 1,27GB. Un cop descomprimit l'arxiu **raspbianEcat00.img** ocupa 7,9GB. L'ocupació real de la imatge és de menys de 5GB. La primera opció del configurador raspi-config és per a expandir la imatge a la mida màxima de la vostra targeta SD concreta.

```
pi@raspberrypi ~ $ sudo raspi-config
```



# Comunicacions amb Raspberry Pi

## Càrrega del protocol Firmata a l'Arduino

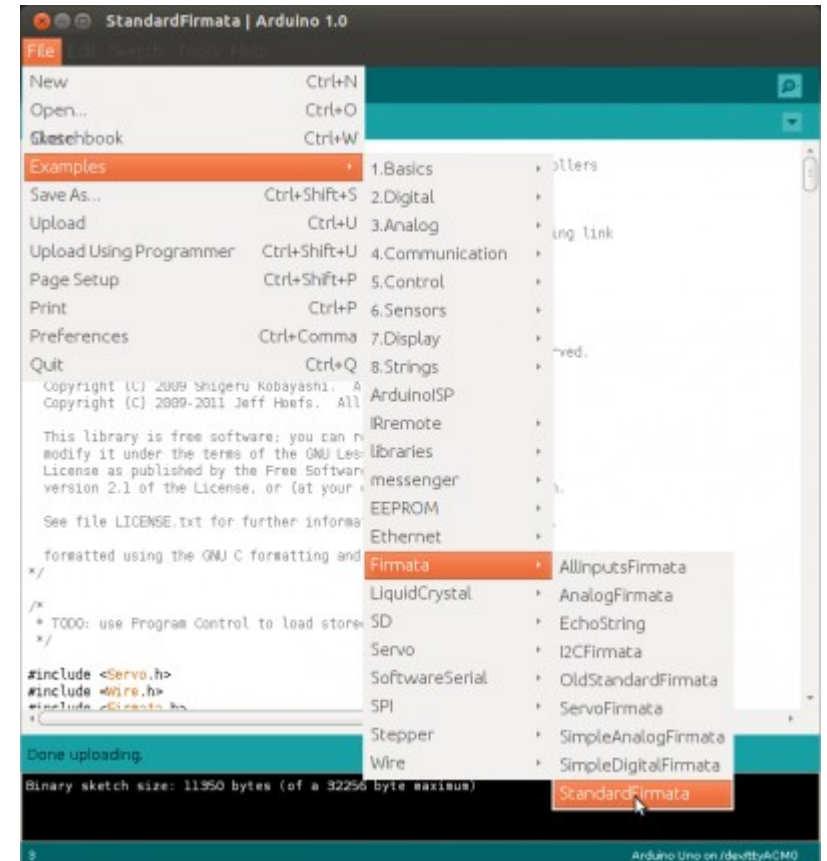
Connecteu la Raspberry Pi a la placa nano-eCat (la que conté l'Arduino Nano) mitjançant el cable USB-A a miniUSB.

A la Raspberry Pi aneu a Menú / Electrònica / Arduino IDE.

A l'Arduino IDE aneu a Fitxer / Exemples / Firmata / Standard Firmata.

Un cop l'Arduino IDE té carregat el programa Standard Firmata, premeu a la icona de la fletxa que apunta a la dreta (quan passeu el ratolí per sobre hi sortirà el text "Puja" a la seva dreta).

Un cop hi surti el text "Pujada enllestida" de color negre sobre fons verd a la part de sota de l'IDE, ja està preparat l'Arduino Nano per establir comunicacions seguint el protocol Firmata.





# Comunicacions amb Raspberry Pi

## Prova del protocol Firmata entre l'Arduino i la Raspberry Pi

A la Raspberry Pi aneu a Menú / Accessoris / LXTerminal i escriviu el següent :

```
pi@raspberrypi ~ $ cd Documents/codis/firmata/pyQt/
pi@raspberrypi ~/Documents/codis/firmata/pyQt $ ls -ls
total 24
8 -rwxr-xr-x 1 pi pi 4122 des  7 21:10 exFirmata03P1.py
4 -rwxr-xr-x 1 pi pi 3970 des  7 20:57 exFirmata03P2.py
4 -rw-r----- 1 pi pi 3255 abr  9 13:31 led_uSw.ui
4 -rw-r--r-- 1 pi pi 3954 des  5 16:25 ui_led_uSw.py
4 -rw-r--r-- 1 pi pi 3058 abr  9 13:33 ui_led_uSw.pyc
pi@raspberrypi ~/Documents/codis/firmata/pyQt $ ./exFirmata03P2.py
```

Us sortirà la finestra de la dreta amb diverses caselles de selecció. Seleccioneu i deseleccioneu la casella corresponent a Led Bit 7 i observeu com canvia d'estat (il·luminat / apagat) el led integrat a l'Arduino.

CheckBox

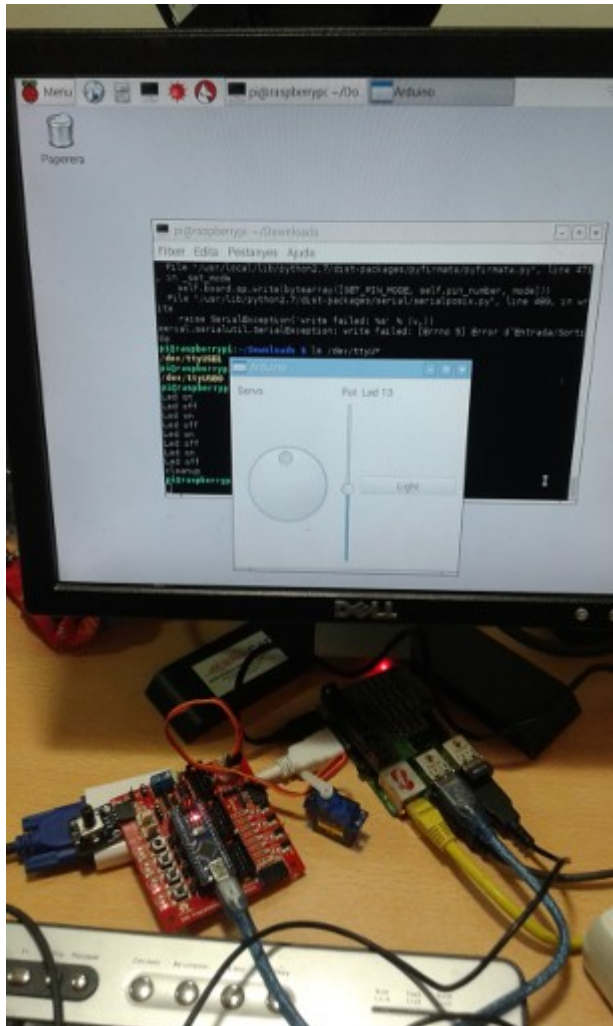
- ☒ Led Bit 7
- ☐ Led Bit 6
- ☒ Led Bit 5
- ☒ Led Bit 4
- ☐ uSw Bit 3
- ☐ uSw Bit 2
- ☐ uSw Bit 1
- ☐ uSw Bit 0

Surt



# Comunicacions amb Raspberry Pi

## Raspberry Pi amb pyfirmata i Arduino amb firmata estàndard



Codi per a la Raspberry Pi ([qtgui03.py](#))

Cal tenir instal·lada la biblioteca pyfirmata:

**sudo pip install pyfirmata**

Més informació : <http://binefa.cat/blog/?p=102>  
Vídeo: <https://youtu.be/2kSSPvfXqug>



# Comunicacions amb Raspberry Pi

## Protocol Firmata



<http://firmata.org/wiki/V2.3ProtocolDetails>

Vídeo de com funciona firmata : <https://youtu.be/l4jFQIoY9ZY>





# Comunicacions amb Raspberry Pi

## Ús de pyFirmata

### Usage

---

Basic usage:

```
>>> from pyfirmata import Arduino, util
>>> board = Arduino('/dev/tty.usbserial-A6008rIF')
>>> board.digital[13].write(1)
```

To use analog ports, it is probably handy to start an iterator thread. Otherwise the board will keep sending data to your serial, until it overflows:

```
>>> it = util.Iterator(board)
>>> it.start()
>>> board.analog[0].enable_reporting()
>>> board.analog[0].read()
0.661440304938
```

: . Eg. `a:0:i` for analog 0 as input or `d:3:p` for digital pin 3 as pwm.:

```
>>> analog_0 = board.get_pin('a:0:i')
>>> analog_0.read()
0.661440304938
>>> pin3 = board.get_pin('d:3:p')
>>> pin3.write(0.6)
```

<https://github.com/tino/pyFirmata>



# Comunicacions amb Raspberry Pi

## Ús del minicom

Aprofitant que està carregat l'Arduino amb un programa que empra comunicacions (trametent un 1 s'il·lumina un led, trametent un 2 s'apaga i movent el microrruptor l'Arduino tramet a la Raspberry Pi una H o una L), farem ús del programa minicom per a establir les comunicacions.

És important assegurar-se de que cap altre programa està fent ús del canal sèrie. Ni l'Arduino IDE ni l'ArduBlock.

```
pi@raspberrypi ~ $ minicom -b 9600 -o -D /dev/ttyUSB0
```

```
Welcome to minicom 2.6.1

OPTIONS: I18n
Compiled on Apr 28 2012, 19:24:31.
Port /dev/ttyUSB0

Press CTRL-A Z for help on special keys

L
H
```

Prement 1 s'il·lumina un led, trametent un 2 s'apaga (quan escrivim no hi surt res pel minicom perquè l'Arduino no fa eco del que li trametem) i movent el microrruptor l'Arduino tramet a la Raspberry Pi una H o una L. Per sortir-ne : Ctrl A + Z, X i Yes



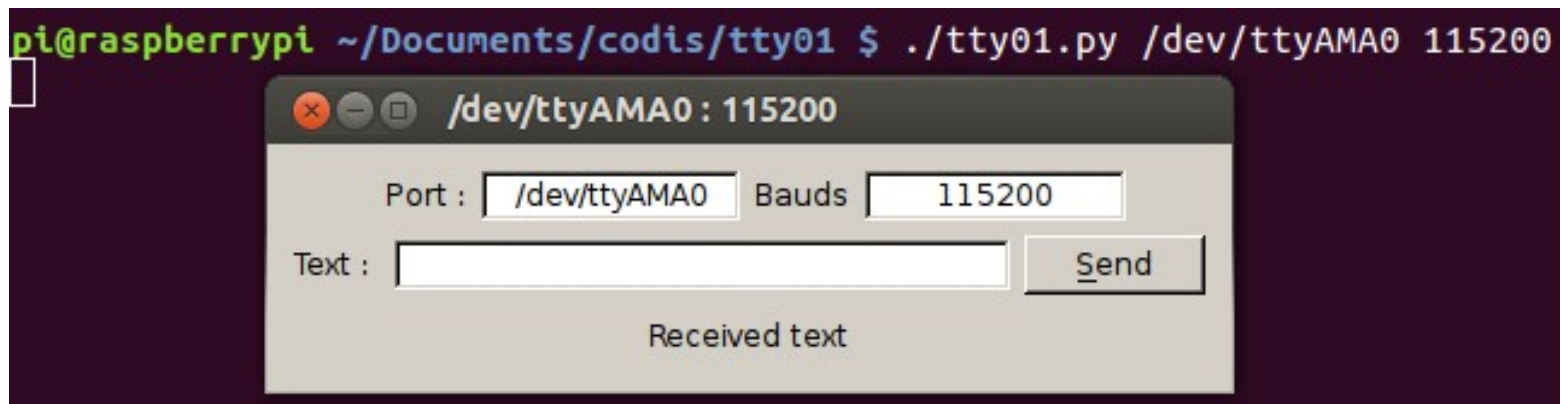
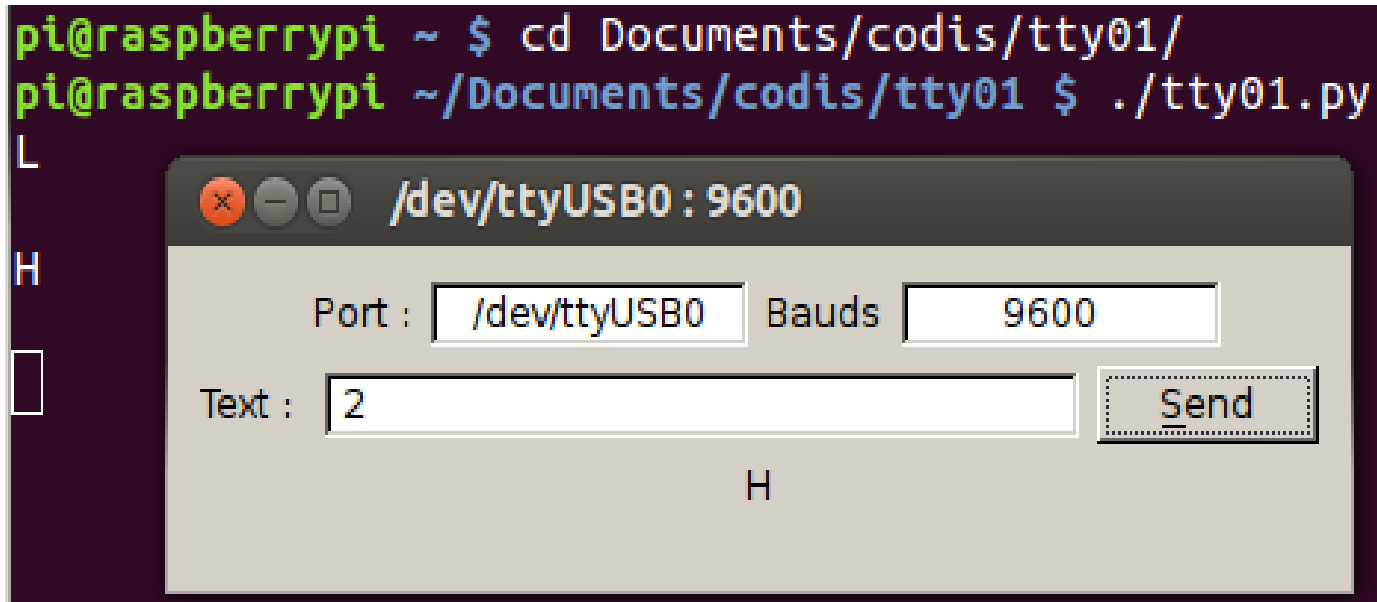
# Comunicacions amb Raspberry Pi

## Ús del port sèrie des de Python

```
1  #!/usr/bin/python
2
3  import serial
4
5  print "Python serial port sample"
6
7  rpiSerialPort = '/dev/ttyAMA0'
8  ser = serial.Serial(rpiSerialPort, 115200)
9
10 ser.write("\n\rFrom Raspberry Pi\n\r")
11 ser.close()
12
```

# Comunicacions amb Raspberry Pi

## Ús d'un programa amb interfície gràfica







# Comunicacions amb Raspberry Pi

## Codi d'Arduino

```
/*  
serialWrRd01.ino  
  
http://www.binefa.cat/php/arduino/serialWrRd01.zip  
*/  
  
void setup() {  
  // Velocitat de la comunicacio en bauds  
  Serial.begin(9600);  
}  
  
void loop() {  
  byte byteLlegit;  
  /* Si hi ha quelcom a llegir: */  
  if (Serial.available()) {  
    /* llegeix el byte mes recent */  
    byteLlegit = Serial.read();  
    /* Retorna el valor llegit. Es a dir, fa eco.*/  
    Serial.write(byteLlegit);  
  }  
}
```

<http://www.binefa.cat/php/arduino/serialWrRd01.zip>

```

/*
serialWrRd02.ino
http://www.binefa.cat/php/arduino/serialWrRd02.zip
*/
#include <ecat.h>
Ecat ecat;

void setup() {
    // Els 4 bits (nibble) baixos de P2 son d'entrada
    ecat.setupNibbleMode(NIBBLE_L_P2, INPUT);
    // Els 4 bits (nibble) alts de P2 son de sortida
    ecat.setupNibbleMode(NIBBLE_H_P2, OUTPUT);
    // Velocitat de la comunicacio en bauds
    Serial.begin(9600);
}

void loop() {
    byte byteLlegit;
    /* Si hi ha quelcom a llegir: */
    if (Serial.available()) {
        /* llegeix el byte mes recent */
        byteLlegit = Serial.read();
        /* Retorna el valor llegit. Es a dir, fa eco.*/
        Serial.write(byteLlegit);
        if(byteLlegit == '1'){
            digitalWrite(ecat.nPinP2B7, HIGH);
        }
        if(byteLlegit == '2'){
            digitalWrite(ecat.nPinP2B7, LOW);
        }
    }
}

```

<http://www.binefa.cat/php/arduino/serialWrRd03.zip>

```
/*
serialWrRd03.ino
http://www.binefa.cat/php/arduino/serialWrRd03.zip
*/
#include <ecat.h>
Ecat ecat;

void setup() {
  ecat.setupNibbleMode(NIBBLE_L_P2, INPUT);
  ecat.setupNibbleMode(NIBBLE_H_P2, OUTPUT);
  Serial.begin(9600);
}

void vIterpretaByteLlegit(byte by){
  if(by == '1')
    digitalWrite(ecat.nPinP2B7, HIGH);
  if(by == '2')
    digitalWrite(ecat.nPinP2B7, LOW);
}

bool bCanviP2B0(){
  static bool bNivellP2B0 = digitalRead(ecat.nPinP2B0);

  if(bNivellP2B0 != digitalRead(ecat.nPinP2B0)){
    bNivellP2B0 = digitalRead(ecat.nPinP2B0);
    return true;
  }
  return false;
}

void vTrametValor(byte byQuinPin){
  if(digitalRead(ecat.nPinP2B0))
    Serial.write('H');
  else
    Serial.write('L');
}

void loop() {
  byte byteLlegit;

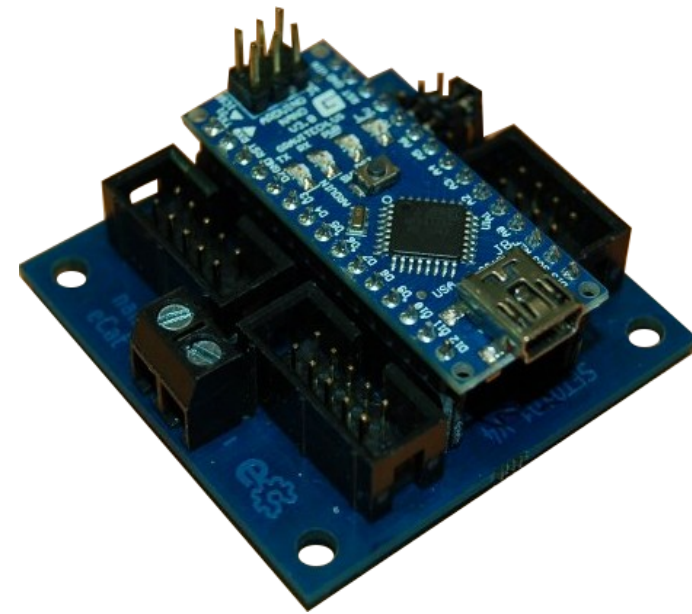
  if (Serial.available()) {
    byteLlegit = Serial.read();
    Serial.write(byteLlegit);
    vIterpretaByteLlegit(byteLlegit);
  }
  if( bCanviP2B0() ){
    delay(100); // Per a evitar rebots
    vTrametValor(ecat.nPinP2B0);
  }
}
```

# eCat Maquinari lliure amb Arduino Nano

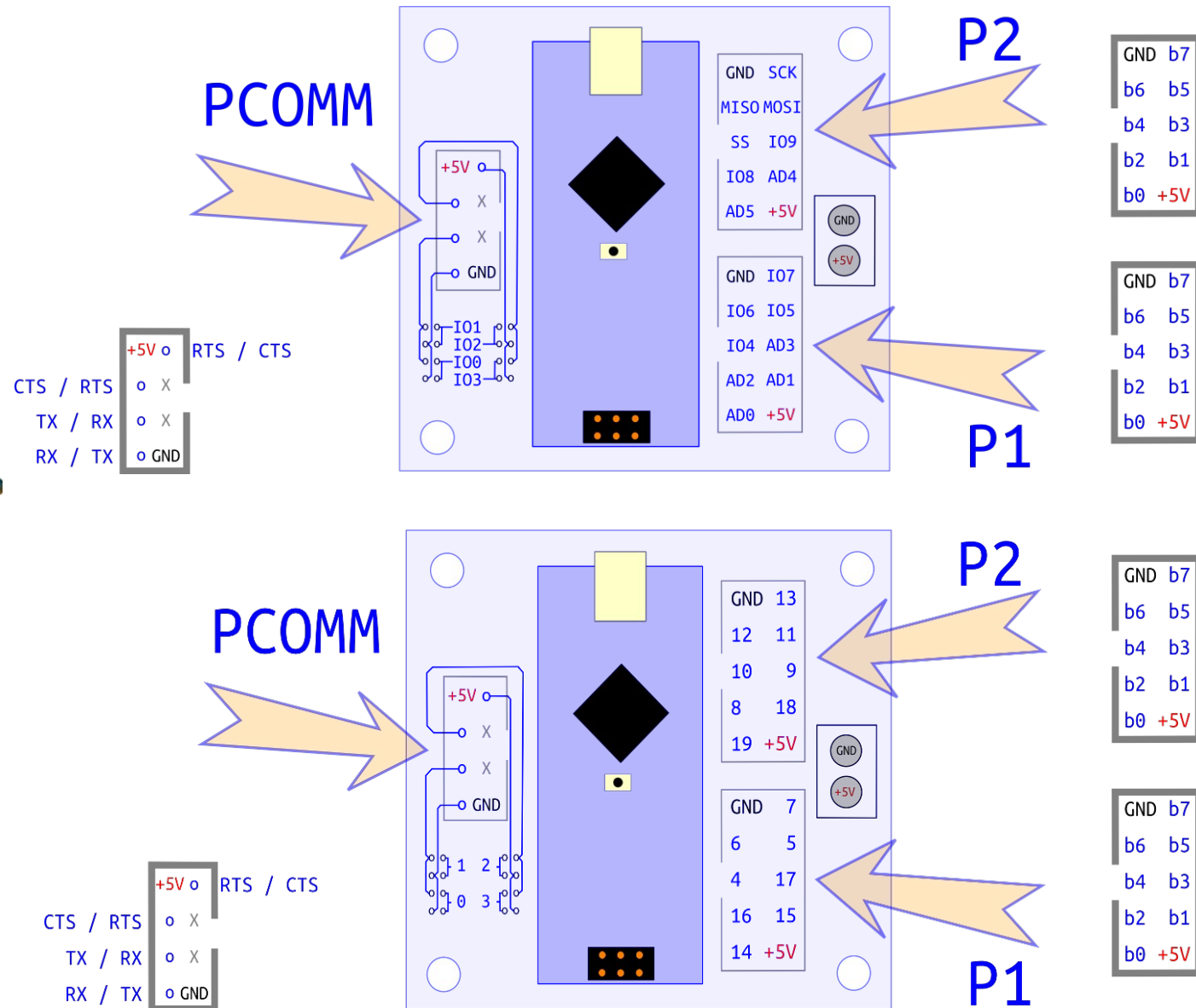
## Plaques amb sistema de bus lliure eCat

### nano-eCat

Placa 0101 v4



Placa convertidora de l'Arduino Nano al sistema de bus lliure eCat System

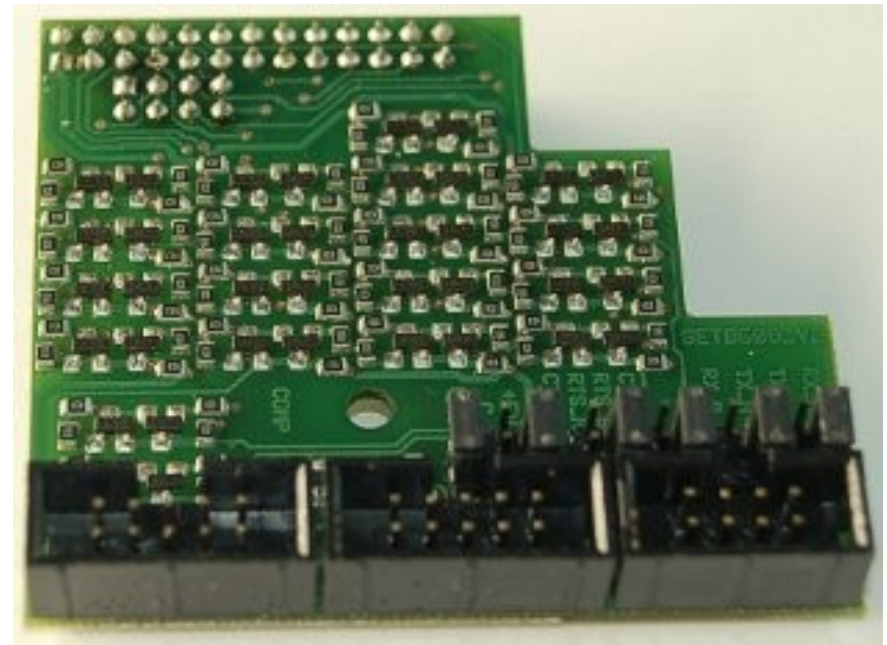






# Maquinari

## 3Bpi - Pi de les Tres Branques Placa traductora de nivells per a Raspberry Pi Placa set05\_08\_v2





# Arduino i Raspberry Pi

**BUS** : Sistema digital que transfereix dades entre dispositius electrònics

|     |     |
|-----|-----|
| GND | b7  |
| b6  | b5  |
| b4  | b3  |
| b2  | b1  |
| b0  | +5V |

Cable pla  
5x2 a 5x2  
(0104A)



CTS / RTS

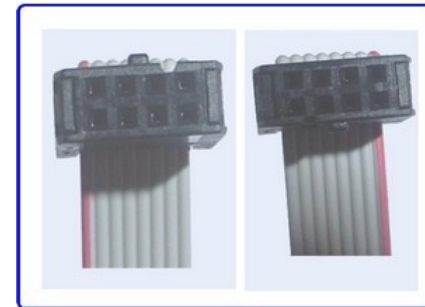
TX / RX

RX / TX

|           |       |
|-----------|-------|
| +5V       | o     |
| CTS / RTS | o X   |
| TX / RX   | o X   |
| RX / TX   | o GND |

CTS / RTS

Cable pla  
4x2 a 4x2  
(0311)

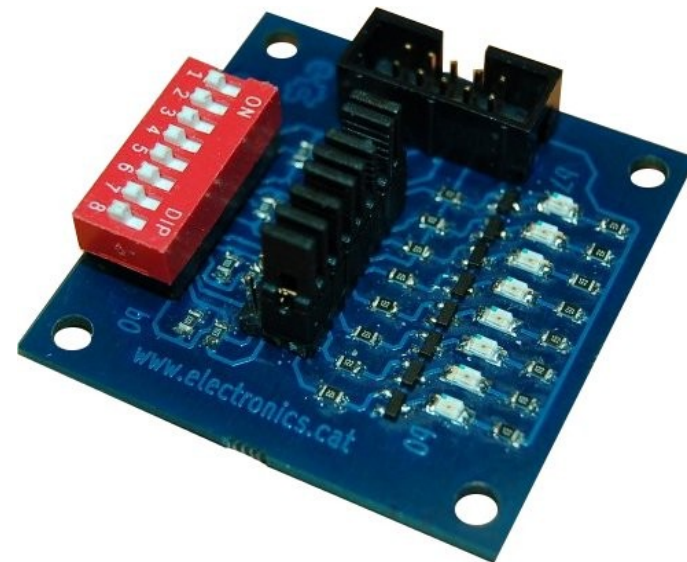
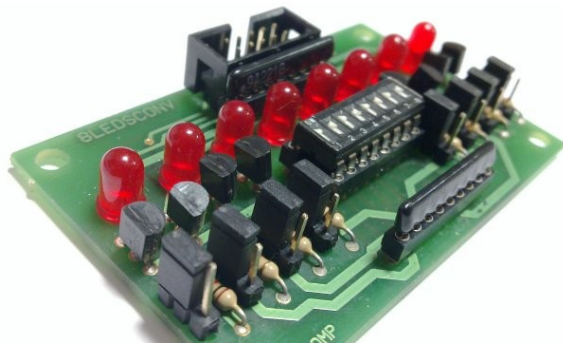
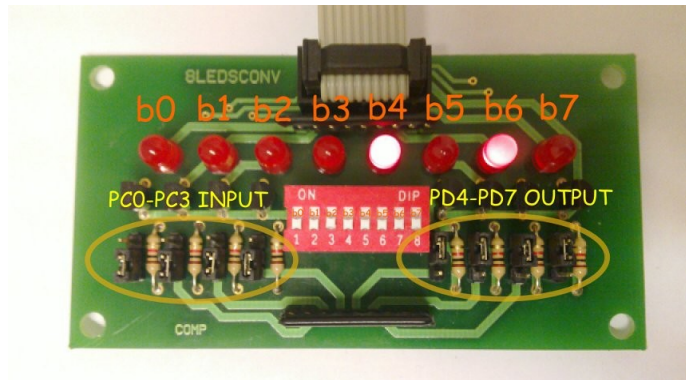
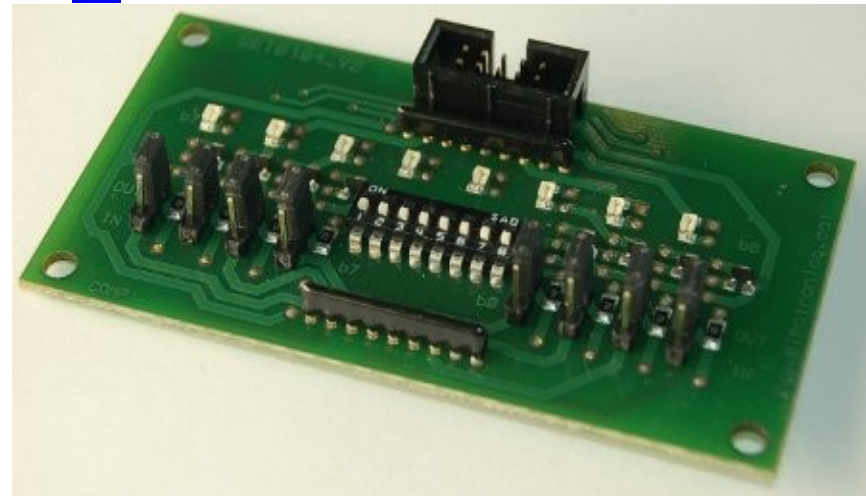
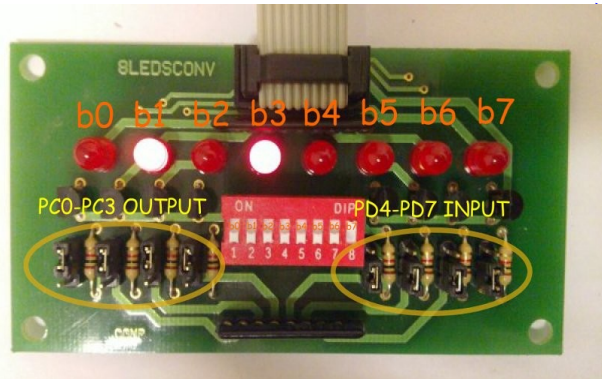


**eCat System** : Dues tipologies de BUS, dades (8 bits) i comunicacions



# Arduino i Raspberry Pi

## Leds i microrruptors - Placa set01\_04







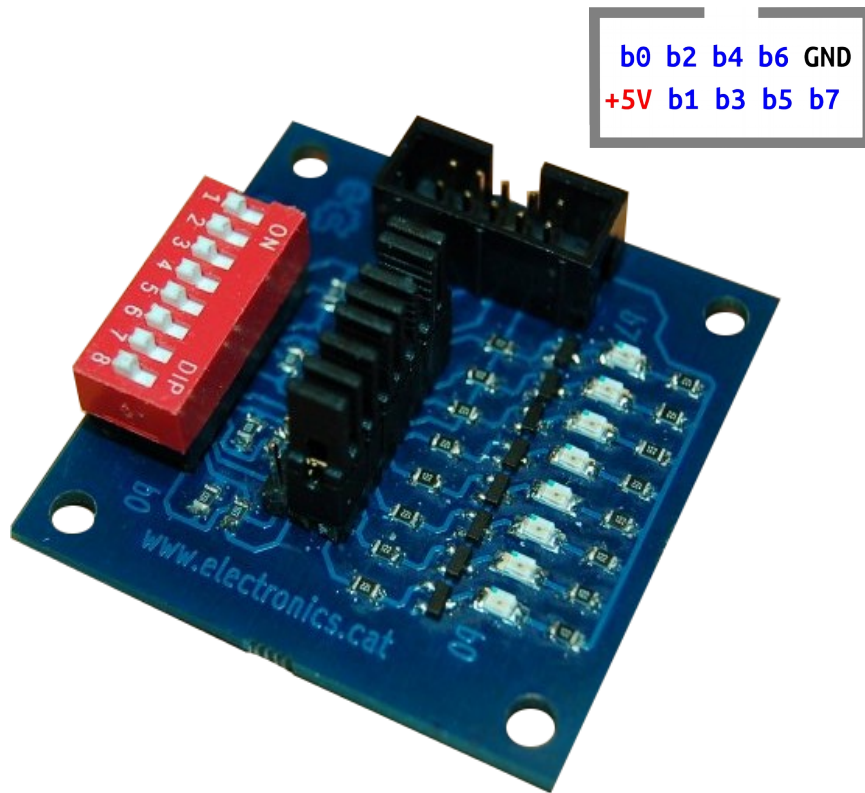
# Arduino i Raspberry Pi

## Plaques amb sistema de bus lliure

### eCat

#### uSW - LEDs

01\_04 v3



Placa configurable  
d'entrades / sortides.

La configuració de cada bit es  
fa mitjançant un pont (jumper).

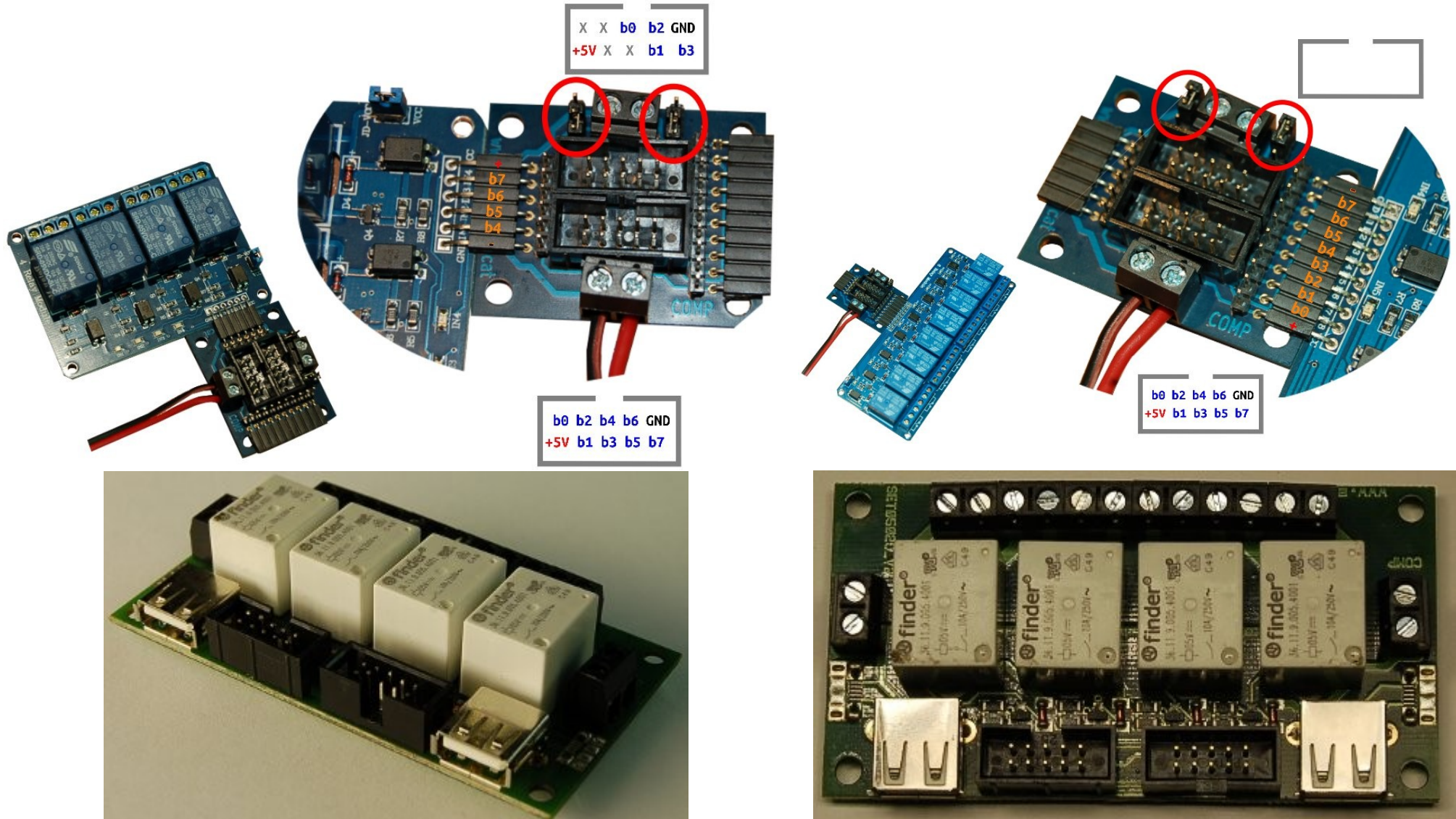
Les entrades es fan per  
microrruptor (ON : zero lògic,  
OFF : u lògic).

Les sortides es visualitzen  
mitjançant leds (apagat : zero  
lògic, encès : u lògic).



# Maquinari

## 4 Relés - Placa set05\_02



<http://electronics.cat/php/common/index.php?lang=ca&page=502>





# Arduino i Raspberry Pi



Conjunt d'una Raspberry Pi amb plaques de <http://www.electronics.cat/>

# Accès a la GPIO emprant Qt

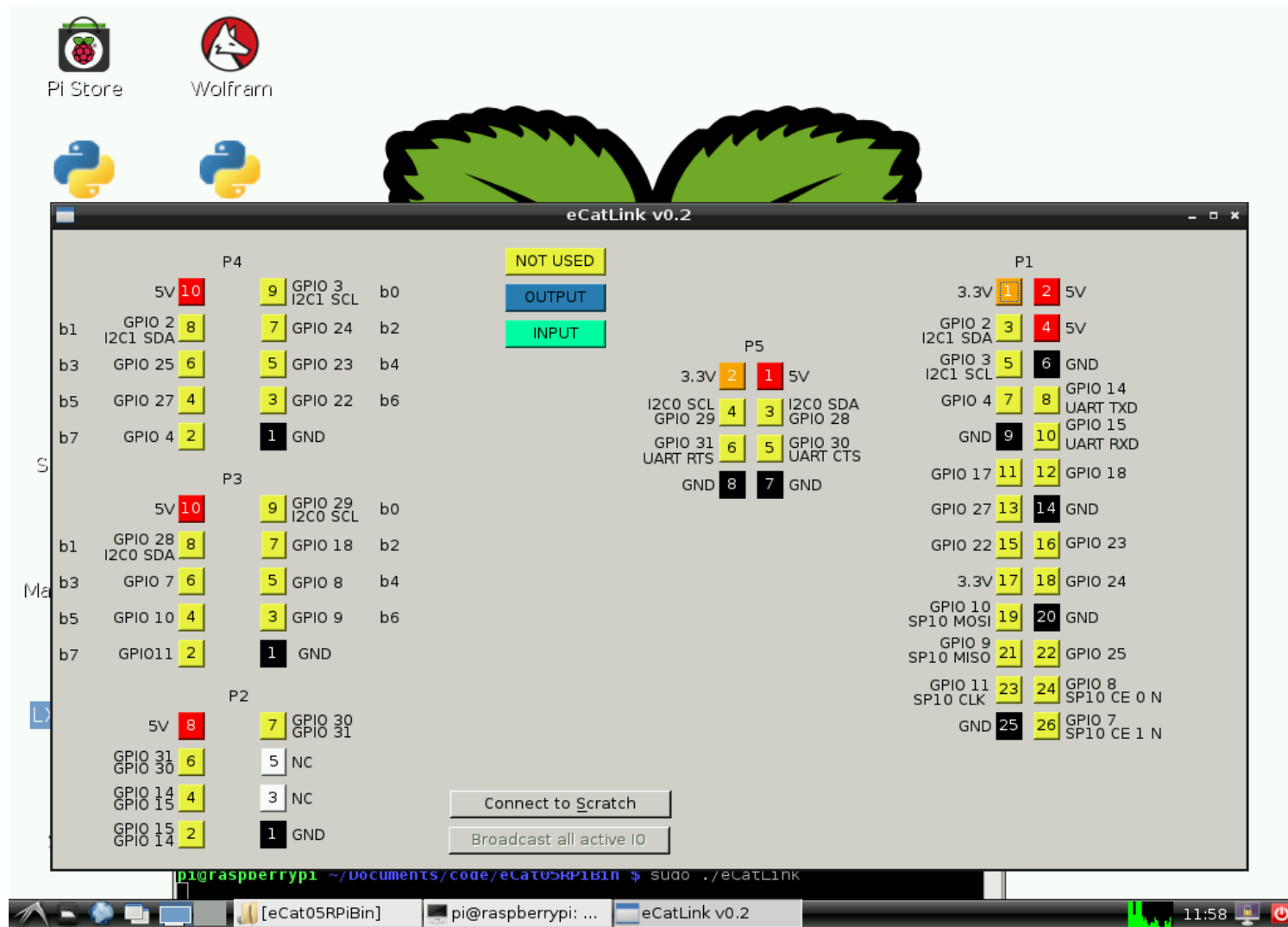


**Code less.  
Create more.  
Deploy everywhere.**

<http://qt-project.org/>

# Accès a la GPIO emprant Qt eCatLink

95



# Accès a la GPIO emprant Qt

96

## eCatLink

eCatLink v0.2

**P4**

5V 10 ☒ 9 GPIO 3 I2C1 SCL b0

b1 GPIO 2 I2C1 SDA 8 ☒ 7 GPIO 24 b2

b3 GPIO 25 6 ☒ 5 GPIO 23 b4

b5 GPIO 27 4 ☐ 3 GPIO 22 b6

b7 GPIO 4 2 ☐ 1 GND

**P3**

5V 10 ☐ 9 GPIO 29 I2C0 SCL b0

b1 GPIO 28 I2C0 SDA 8 ☐ 7 GPIO 18 b2

b3 GPIO 7 6 ☐ 5 GPIO 8 b4

b5 GPIO 10 4 ☐ 3 GPIO 9 b6

b7 GPIO11 2 ☐ 1 GND

**P2**

5V 8 7 GPIO 30 GPIO 31

GPIO 31 6 5 NC

GPIO 14 4 3 NC

GPIO 15 2 1 GND

**P5**

3.3V 2 1 5V

I2C0 SCL 4 3 I2C0 SDA GPIO 28

GPIO 29 6 5 GPIO 30 UART CTS

UART RTS 8 7 GND

**P1**

3.3V 1 2 5V

GPIO 2 I2C1 SDA 3 4 5V

GPIO 3 I2C1 SCL 5 6 GND

GPIO 4 7 8 GPIO 14 UART TXD

GND 9 10 GPIO 15 UART RXD

GPIO 17 11 12 GPIO 18

GPIO 27 13 14 GND

GPIO 22 15 16 GPIO 23

3.3V 17 18 GPIO 24

GPIO 10 SPI0 MOSI 19 20 GND

GPIO 9 SPI0 MISO 21 22 GPIO 25

GPIO 11 SPI0 CLK 23 24 GPIO 8 SPI0 CE 0 N

GND 25 26 GPIO 7 SPI0 CE 1 N

NOT USED

OUTPUT

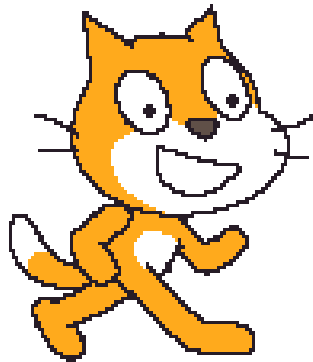
INPUT

Connect to Scratch

Broadcast all active IO



# SCRATCH

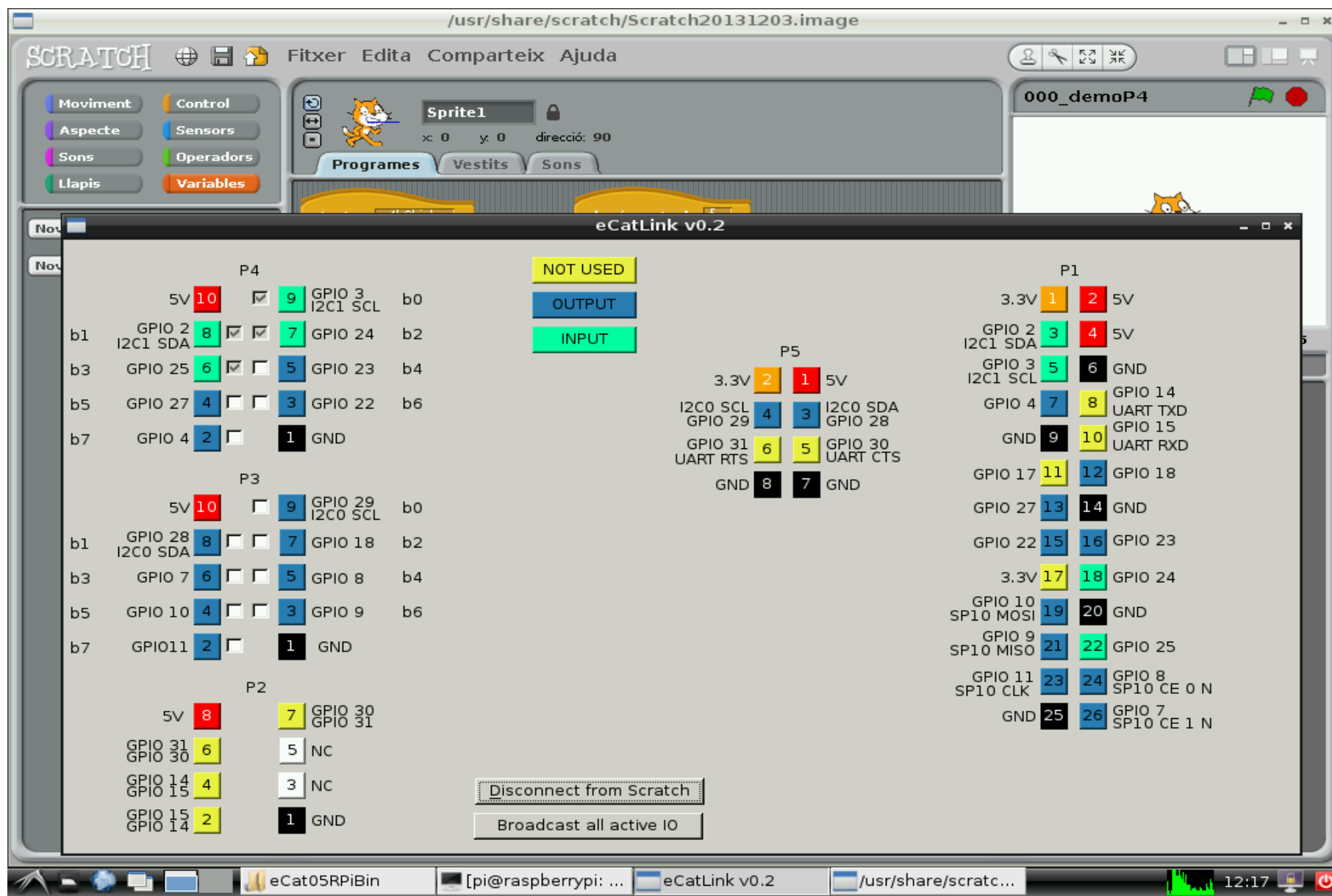


+



# Maquinari

## Fent ús de P4 - eCatLink



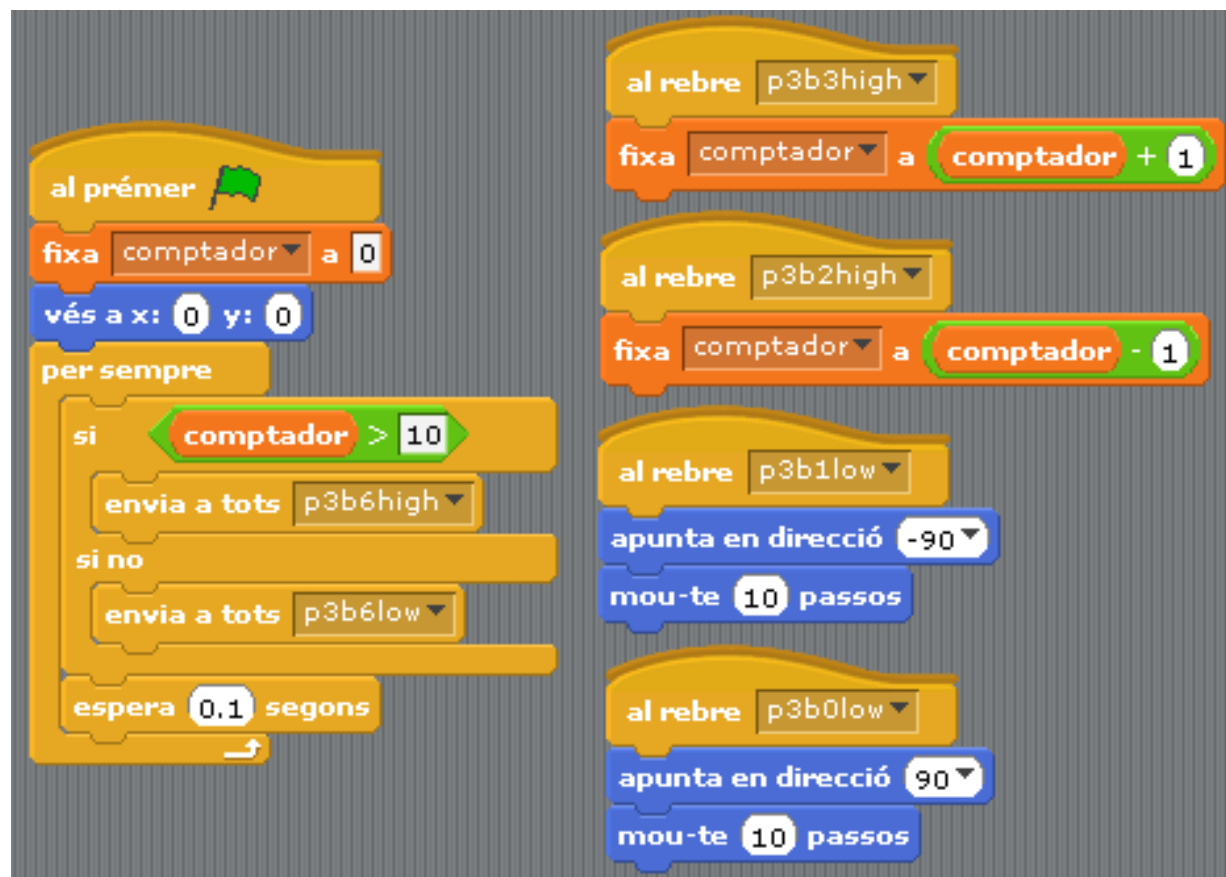
# Maquinari

## eCatLink + Scratch



# Maquinari

## eCatLink + Scratch



[http://www.binefa.cat/php/raspberryPi/scratch/002\\_cmpt.sb](http://www.binefa.cat/php/raspberryPi/scratch/002_cmpt.sb)



# Maquinari

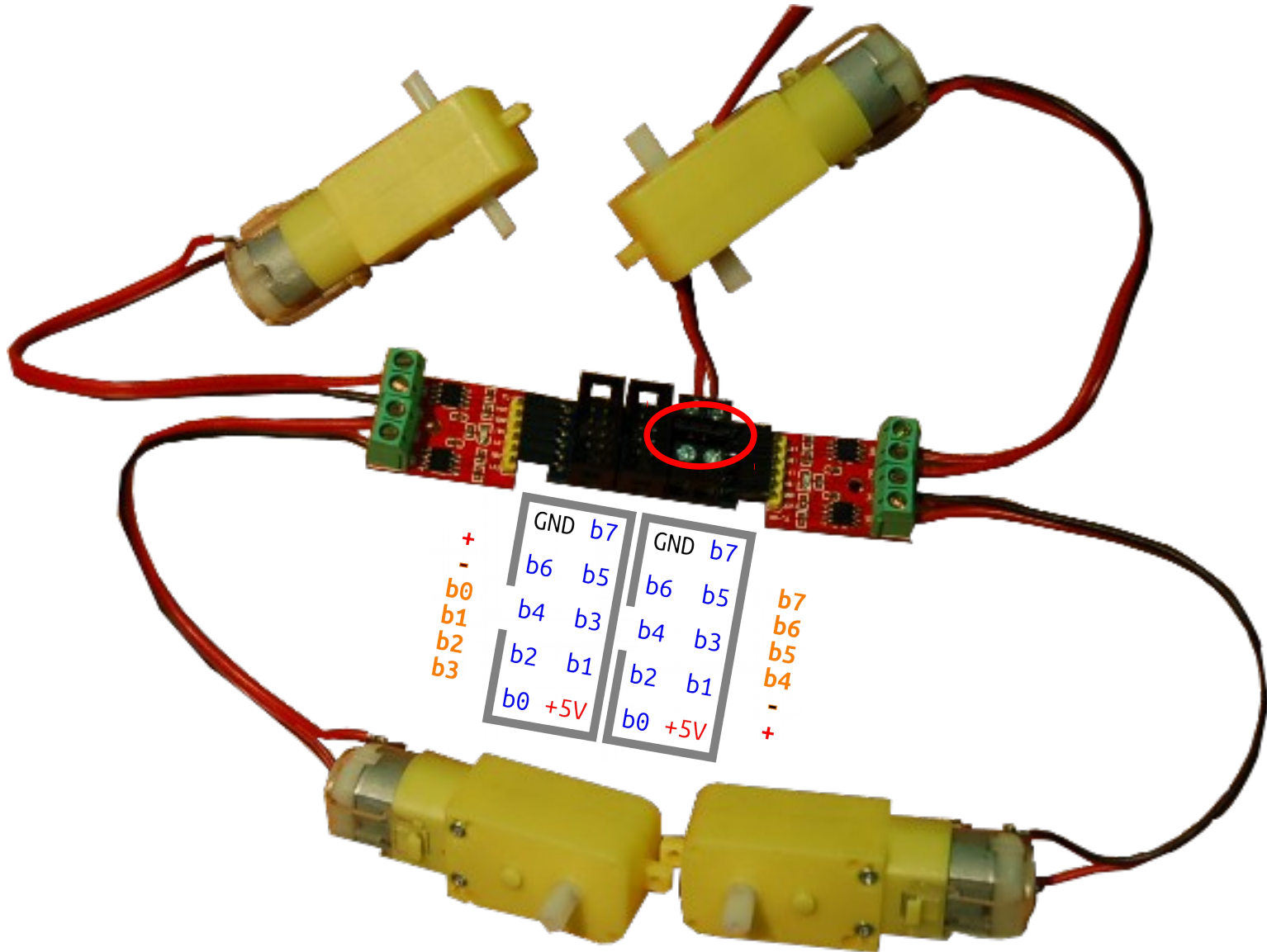
## eCatLink + Scratch





# Maquinari

## Motors emprant mòdul en H



# Accès a la GPIO emprant Python



# Instal·lació del mòdul RPi.GPIO

**\$sudo apt-get update**

**\$sudo apt-get install python-dev**

**\$sudo apt-get install python-rpi.gpio**

**\$sudo aptitude install python-serial**

**\$sudo aptitude install python-netifaces**

**\$sudo usermod -a -G dialout pi**

<http://code.google.com/p/raspberry-gpio-python/wiki/BasicUsage>

# Rpi.GPIO llegint entrades de P3

```
1  #!/usr/bin/env python
2
3  from time import sleep
4  import os
5  import RPi.GPIO as GPIO
6
7  GPIO.setmode(GPIO.BCM)
8  GPIO.setup(29, GPIO.IN)
9  GPIO.setup(28, GPIO.IN)
10 GPIO.setup(18, GPIO.IN)
11 GPIO.setup(7, GPIO.IN)
12
13 while True:
14     if ( GPIO.input(29) == False ):
15         print "GPIO 29 pressed"
16     if ( GPIO.input(28) == False ):
17         print "GPIO 28 pressed"
18     if ( GPIO.input(18) == False ):
19         print "GPIO 18 pressed"
20     if ( GPIO.input(7) == False ):
21         print "GPIO 7 pressed"
22     sleep(0.1);
23
```



# Rpi.GPIO escrivint sortides a P3

10

```
1  #!/usr/bin/env python
2
3  from time import sleep
4  import os
5  import RPi.GPIO as GPIO
6
7  GPIO.setwarnings(False)
8
9  GPIO.setmode(GPIO.BCM)
10 GPIO.setup(8, GPIO.OUT)
11 GPIO.setup(10, GPIO.OUT)
12 GPIO.setup(9, GPIO.OUT)
13 GPIO.setup(11, GPIO.OUT)
14
15 GPIO.output(8,0)
16 GPIO.output(10,0)
17 GPIO.output(9,0)
18 GPIO.output(11,0)
19
```

```
19
20 while True:
21     GPIO.output(8,1)
22     sleep(0.5);
23     GPIO.output(8,0)
24     sleep(0.5);
25     GPIO.output(10,1)
26     sleep(0.5);
27     GPIO.output(10,0)
28     sleep(0.5);
29     GPIO.output(9,1)
30     sleep(0.5);
31     GPIO.output(9,0)
32     sleep(0.5);
33     GPIO.output(11,1)
34     sleep(0.5);
35     GPIO.output(11,0)
36     sleep(0.5);
```

# Control d'un servo - bit7 de P4



# Control d'un servo - p4b2 i n4b3

10

```
1  #!/usr/bin/env python
2
3  from time import sleep
4  import os
5  import RPi.GPIO as GPIO
6
7  GPIO.setwarnings(False)
8
9  GPIO.setmode(GPIO.BCM)
10 GPIO.setup(24, GPIO.OUT)
11 GPIO.setup(25, GPIO.OUT)
12 p = GPIO.PWM(24,50)      # 50Hz
13 q = GPIO.PWM(25,50)      # 50Hz
14 p.start(7.5)
15 q.start(7.5)
16 try:
17     while True:
18         p.ChangeDutyCycle(7.5) # Neutral
19         q.ChangeDutyCycle(7.5) # Neutral
20         sleep(1)
21         # p.ChangeDutyCycle(12.5) # 180 graus
22         p.ChangeDutyCycle(10)   # 180 graus
23         q.ChangeDutyCycle(10)   # 180 graus
24         sleep(1)
25         # p.ChangeDutyCycle(2.5) # 0 graus
26         p.ChangeDutyCycle(4)    # 0 graus
27         q.ChangeDutyCycle(4)    # 0 graus
28         sleep(1)
29 except KeyboardInterrupt:
30     GPIO.cleanup()
```

<http://www.binefa.cat/php/raspberryPi/python/pyServos.py>

Adaptació de codi basat en exemples de <http://www.theraspberrypiguy.com/>

# Lectura de sensor d'ultrasons



# Lectura de sensor d'ultrasons

```

1  #!/usr/bin/python
2
3  def reading(sensor):
4      import time
5      import RPi.GPIO as GPIO
6
7      GPIO.setwarnings(False)
8      GPIO.setmode(GPIO.BCM)
9
10     if sensor == 0:
11         GPIO.setup(22,GPIO.OUT)
12         GPIO.setup(27,GPIO.IN)
13         GPIO.output(22, GPIO.LOW)
14         time.sleep(0.3)
15
16         GPIO.output(22, True)
17         time.sleep(0.00001)
18         GPIO.output(22, False)
19
20         while GPIO.input(27) == 0:
21             signaloff = time.time()
22         while GPIO.input(27) == 1:
23             signalon = time.time()
24
25         timepassed = signalon - signaloff
26         distance = timepassed * 17000
27
28         GPIO.cleanup()
29         return distance
30
31     else:
32         print "Incorrect usonic() function variable."
33
34     print reading(0)
35

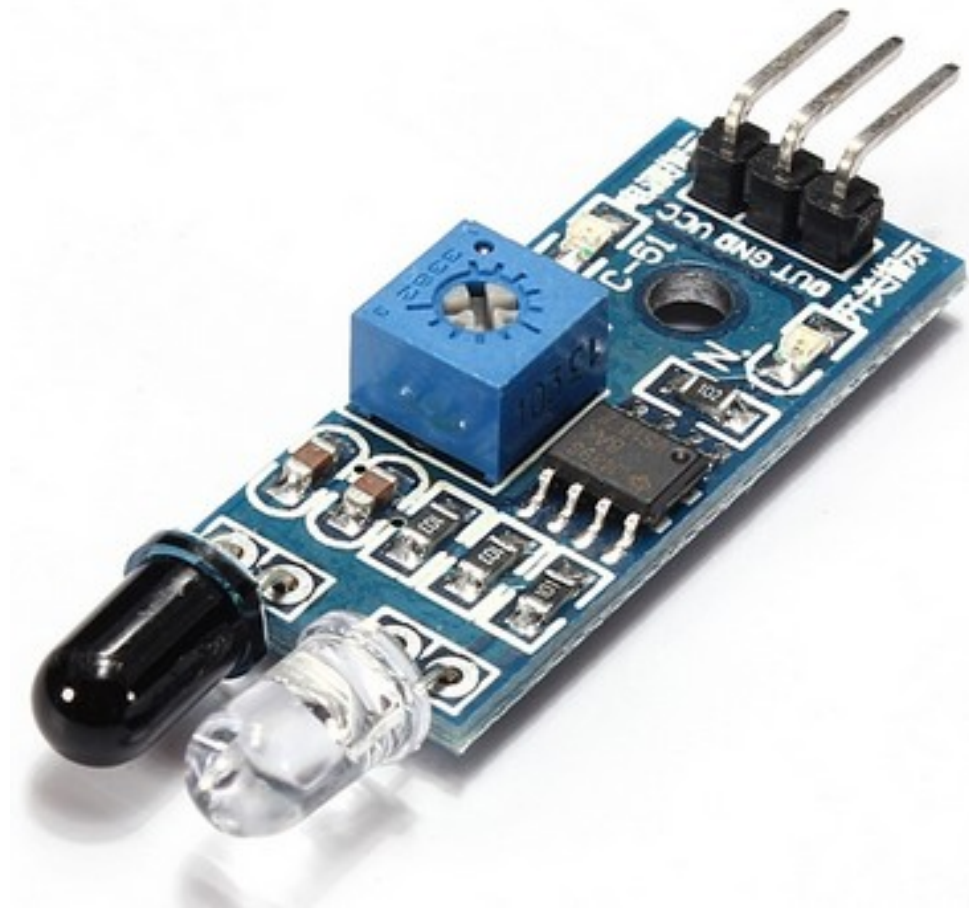
```

<http://www.binefa.cat/php/raspberryPi/python/pyUltrasons.py>

Adaptació de codi basat en exemples de <http://www.theraspberrypiguy.com/>



# Lectura de sensor infrarrojo



# Lectura de sensor infrarroig

```
1  #!/usr/bin/env python
2
3  from time import sleep
4  import os
5  import RPi.GPIO as GPIO
6
7  GPIO.setmode(GPIO.BCM)
8  GPIO.setup(23, GPIO.IN)
9
10 while True:
11     if ( GPIO.input(23) == True ):
12         print "Tapat"
13         sleep(0.1);
14
```

<https://dl.dropboxusercontent.com/u/65254823/oshw20140319/py05.py>

Adaptació de codi basat en exemples de <http://www.theraspberrypiguy.com/>

# Motor pas a pas



# Motor pas a pas

```

1  #!/usr/bin/python
2  import RPi.GPIO as GPIO
3  import time
4
5  GPIO.setmode(GPIO.BCM)
6  ControlPin = [3,2,24,25]
7
8  for pin in ControlPin:
9      GPIO.setup(pin,GPIO.OUT)
10     GPIO.output(pin,0)
11
12  seq = [ [0,0,0,1],
13          [0,0,1,1],
14          [0,0,1,0],
15          [0,1,1,0],
16          [0,1,0,0],
17          [1,1,0,0],
18          [1,0,0,0],
19          [1,0,0,1] ]
20
21  for i in range(512):
22      for halfstep in range(8):
23          for pin in range(4):
24              GPIO.output(ControlPin[pin],seq[halfstep][pin])
25              time.sleep(0.001)
26
12  seq = [ [1,0,0,0],
13          [1,1,0,0],
14          [0,1,0,0],
15          [0,1,1,0],
16          [0,0,1,0],
17          [0,0,1,1],
18          [0,0,0,1],
19          [1,0,0,1] ]
20

```

<https://dl.dropboxusercontent.com/u/65254823/oshw20140319/py04.py>

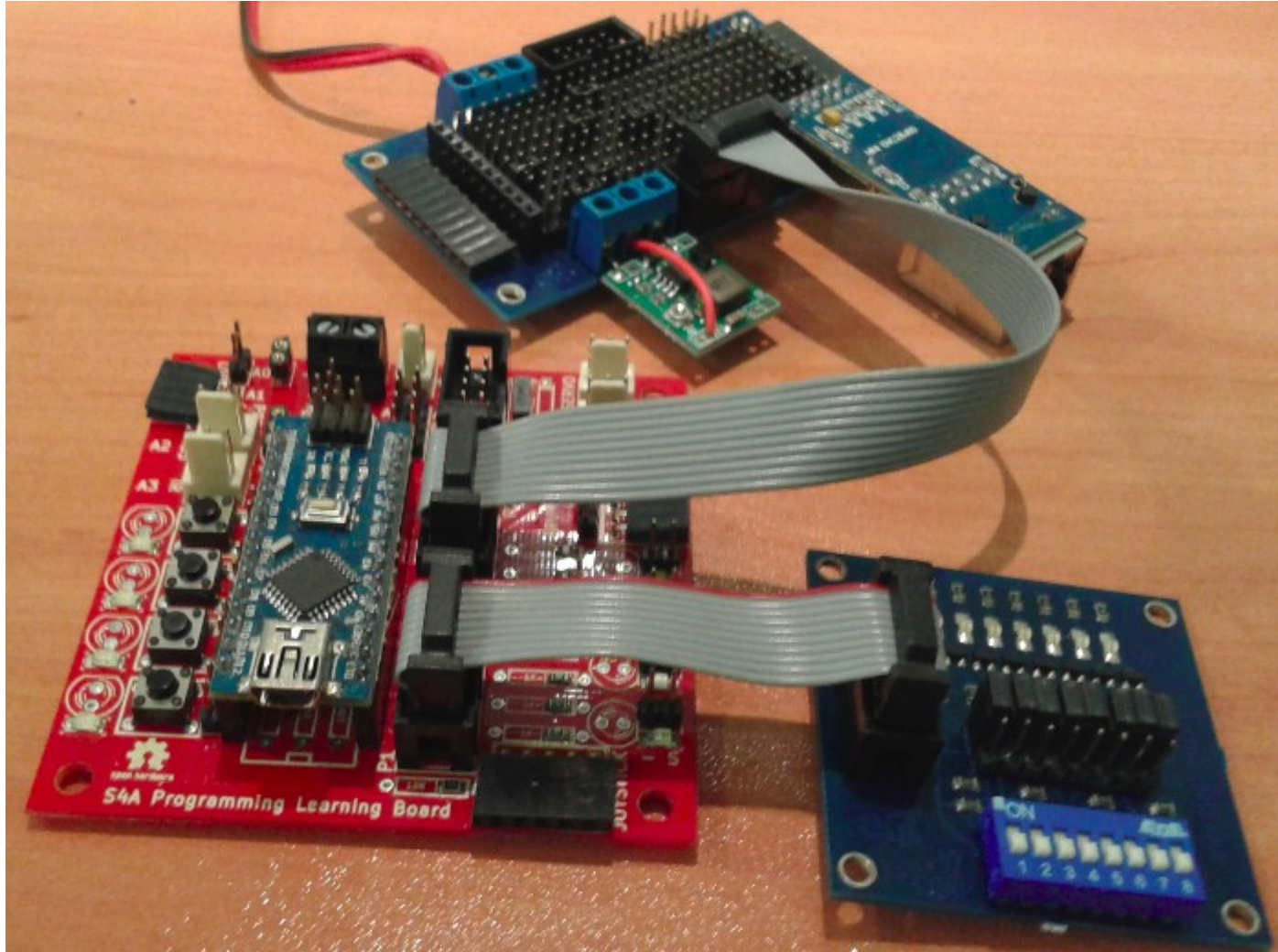
<https://dl.dropboxusercontent.com/u/65254823/oshw20140319/py04b.py>

Adaptació de codi basat en exemples de <http://www.theraspberrypiguy.com/>



# Arduino i Raspberry Pi

## Ethernet



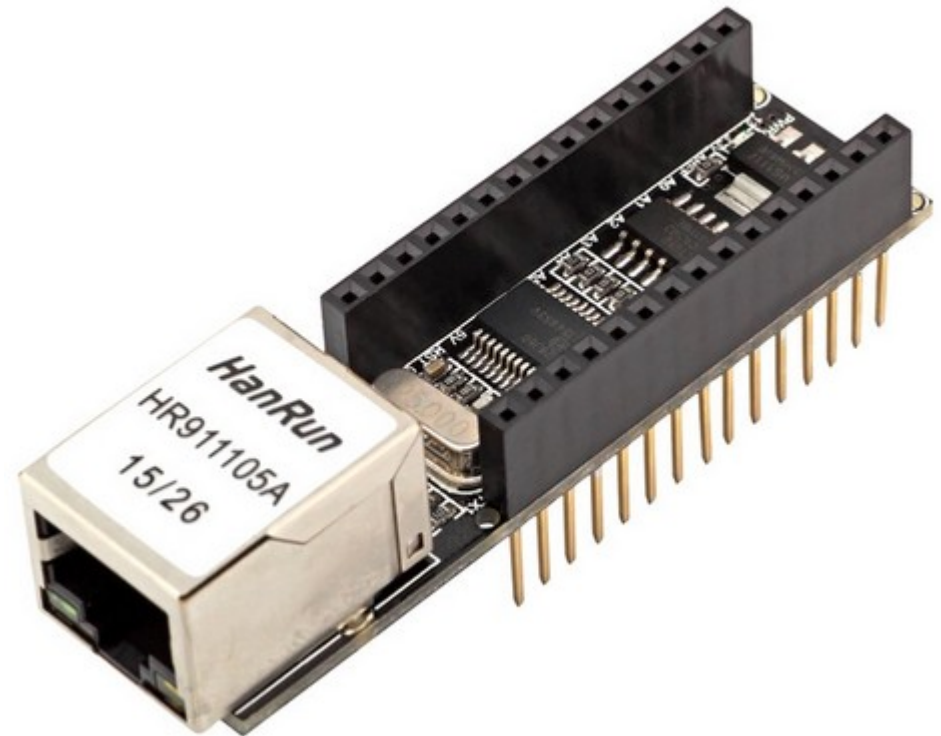
Codi per a Arduino UdpServer01b





# Arduino i Raspberry Pi

## Ethernet – Mòdul ENC28J60

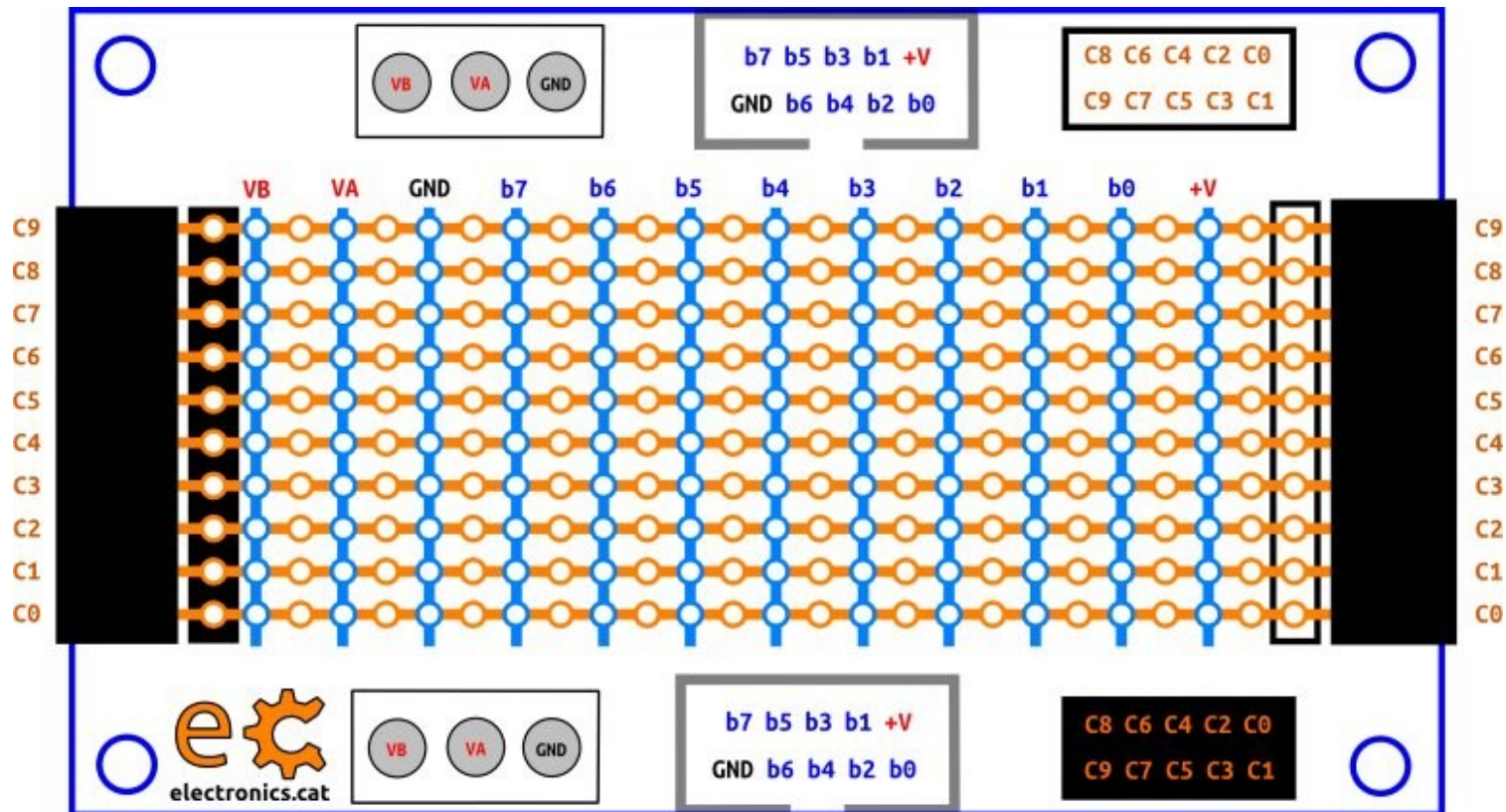


Biblioteca UIPEthernet per Arduino i ENC28J60



# Arduino i Raspberry Pi

## Matriu

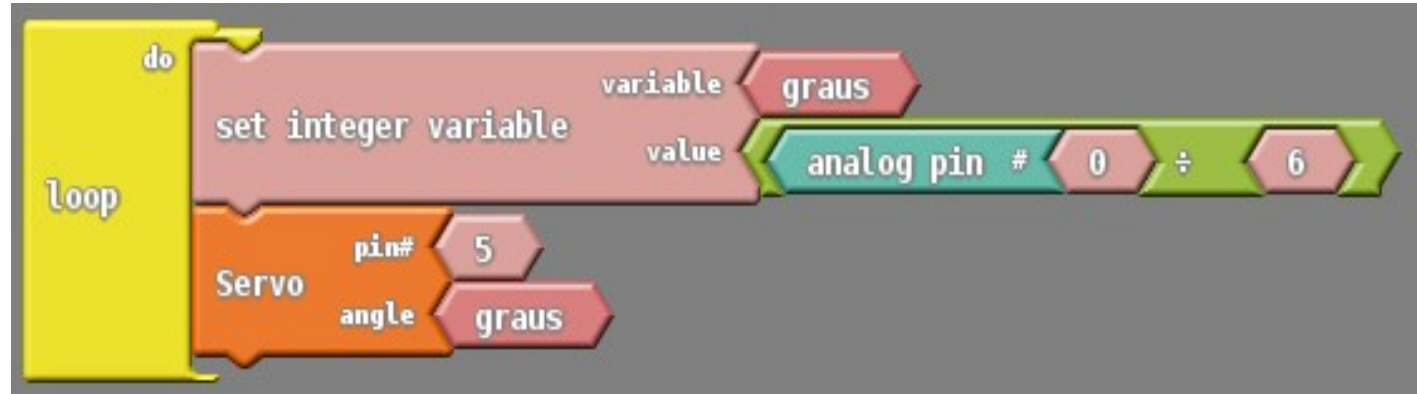
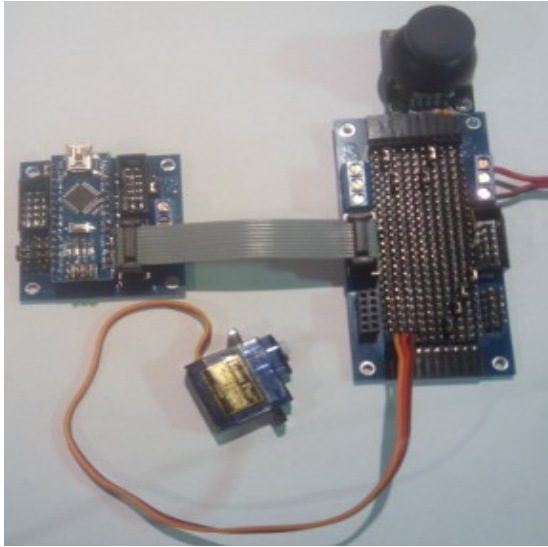


<http://electronics.cat/php/common/index.php?lang=ca&page=517>

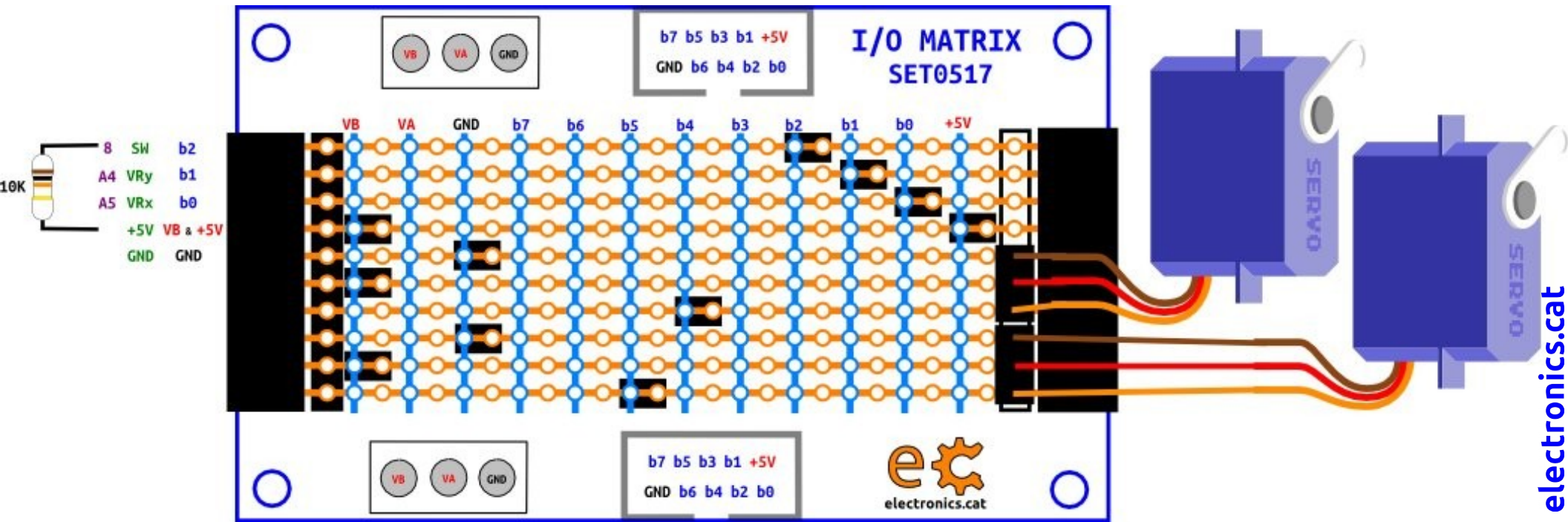


# Arduino i Raspberry Pi

## Exemple d'ús de la matriu



<http://www.binefa.cat/php/arduino/ardublock/pr04joystickServo.abp>







# Arduino i Raspberry Pi

## Matriu

Connexió a la matriu inversa (pàgina 100 del pdf)

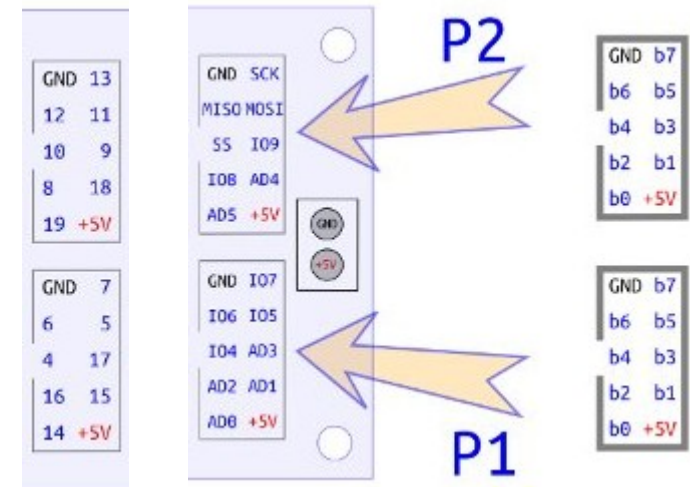
|    |    |    |    |    |
|----|----|----|----|----|
| C8 | C6 | c4 | C2 | C0 |
| C9 | C7 | C5 | C3 | C1 |

Connexió de l'ENC28J60

|     |     |     |     |     |
|-----|-----|-----|-----|-----|
| CLK | WOL | SI  | CS  | VCC |
| INT | S0  | SCK | RST | GND |

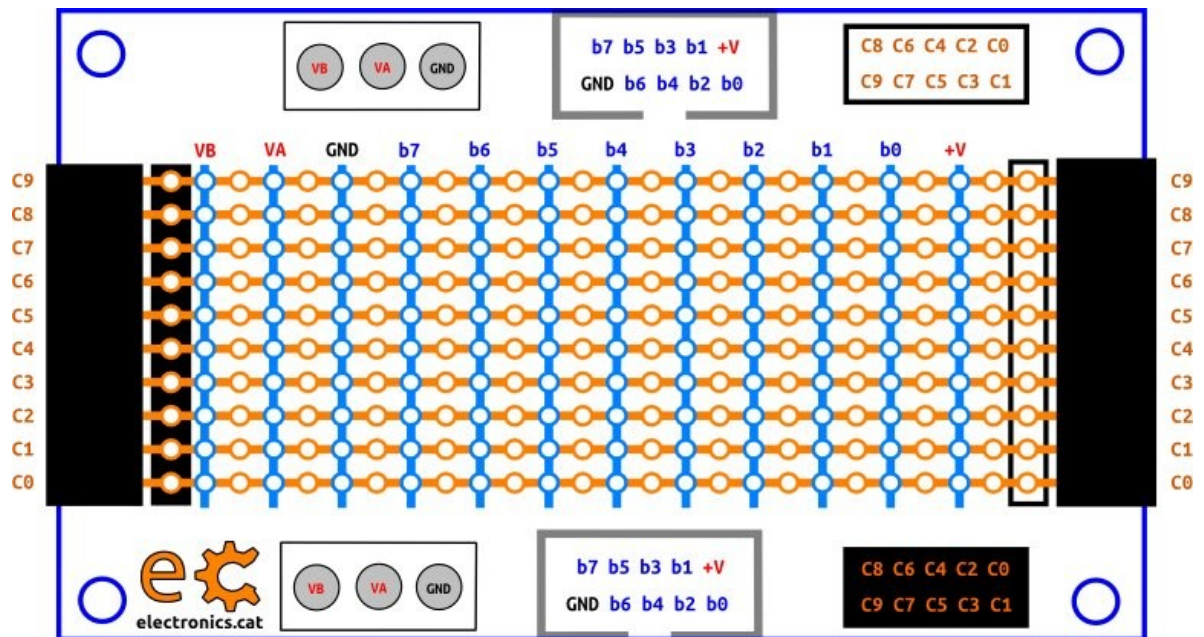
Connexió bus ecat

|    |    |    |     |     |
|----|----|----|-----|-----|
| N  | NC | b5 | b4  | 3V3 |
| NC | b6 | b7 | +5V | GND |



Per pota de connector ecat

|    |     |     |
|----|-----|-----|
| 1  | CK  | NC  |
| 2  | INT | NC  |
| 3  | WOL | NC  |
| 4  | S0  | b6  |
| 5  | SI  | b5  |
| 6  | SCK | b7  |
| 7  | CS  | b4  |
| 8  | RST | +5V |
| 9  | VCC | 3V3 |
| 10 | GND |     |





# Arduino i Raspberry Pi

## Ethernet – Recepció de datagrames UDP

```
#include <UIPEthernet.h>
#include <ecat.h>

EthernetUDP udp;
Ecat ecat;

void setup() {
  Serial.begin(9600);

  uint8_t mac[6] = {0x00,0x01,0x02,0x03,0x04,0x05};

  Ethernet.begin(mac,IPAddress(192,168,1,108));
  //Ethernet.begin(mac,IPAddress(172,20,1,168));

  int success = udp.begin(5000);

  Serial.print("initialize: ");
  Serial.println(success ? "success" : "failed");
  ecat.setupHighNibbleP1(OUTPUT);
}
```

```
void loop() {
  //check for new udp-packet:
  int size = udp.parsePacket();
  if (size > 0) {
    do
    {
      char* msg = (char*)malloc(size+1);
      int len = udp.read(msg,size+1);
      msg[len]=0;
      Serial.print("received: ");
      Serial.print(msg);
      if(msg[0]=='0'){
        digitalWrite(ecat.nPinP1B7, LOW);
      }else{
        if(msg[0]=='1'){
          digitalWrite(ecat.nPinP1B7, HIGH);
        }
      }
      free(msg);
    }
    while ((size = udp.available())>0);
    //finish reading this packet:
    udp.flush();
    Serial.println("");
  }
}
```

Codi per a Arduino UdpServer01b





# Arduino i Raspberry Pi

## Ethernet – Enviament de datagrames UDP

```

int success;
do
{
    Serial.print("remote ip: ");
    Serial.println(udp.remoteIP());
    Serial.print("remote port: ");
    Serial.println(udp.remotePort());
    //send new packet back to ip/port of client. This also
    //configures the current connection to ignore packets from
    //other clients!
    success = udp.beginPacket(udp.remoteIP(),udp.remotePort());
    Serial.print("beginPacket: ");
    Serial.println(success ? "success" : "failed");
    //beginPacket fails if remote ethaddr is unknown. In this case an
    //arp-request is send out first and beginPacket succeeds as soon
    //the arp-response is received.
}
while (!success);

success = udp.println("hello world from arduino");

Serial.print("bytes written: ");
Serial.println(success);

success = udp.endPacket();

Serial.print("endPacket: ");
Serial.println(success ? "success" : "failed");

udp.stop();
//restart with new connection to receive packets from other clients
Serial.print("restart connection: ");
Serial.println (udp.begin(5000) ? "success" : "failed");
}
}

```

Codi per a Arduino UdpServer01b



# Arduino i Raspberry Pi

## Ethernet – Enviament de datagrames UDP

```
$ ./udpOn.py 192.168.1.108
```

```
#!/usr/bin/python

import socket
import sys

szServer = str(sys.argv[1])
nUdpPort = 5000

client_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
client_socket.sendto("1", (szServer, nUdpPort))
client_socket.close()
```

```
$ ./udpOff.py 192.168.1.108
```

```
#!/usr/bin/python

import socket
import sys

szServer = str(sys.argv[1])
nUdpPort = 5000

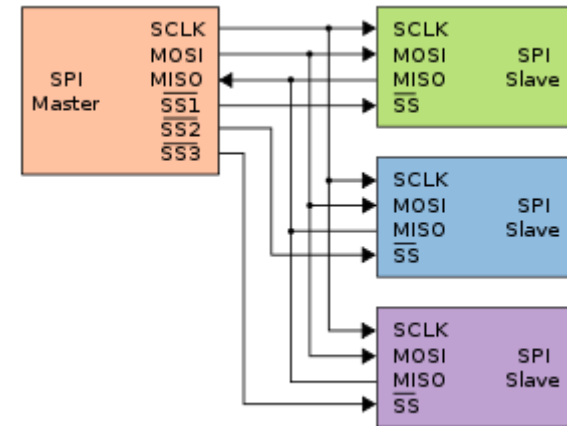
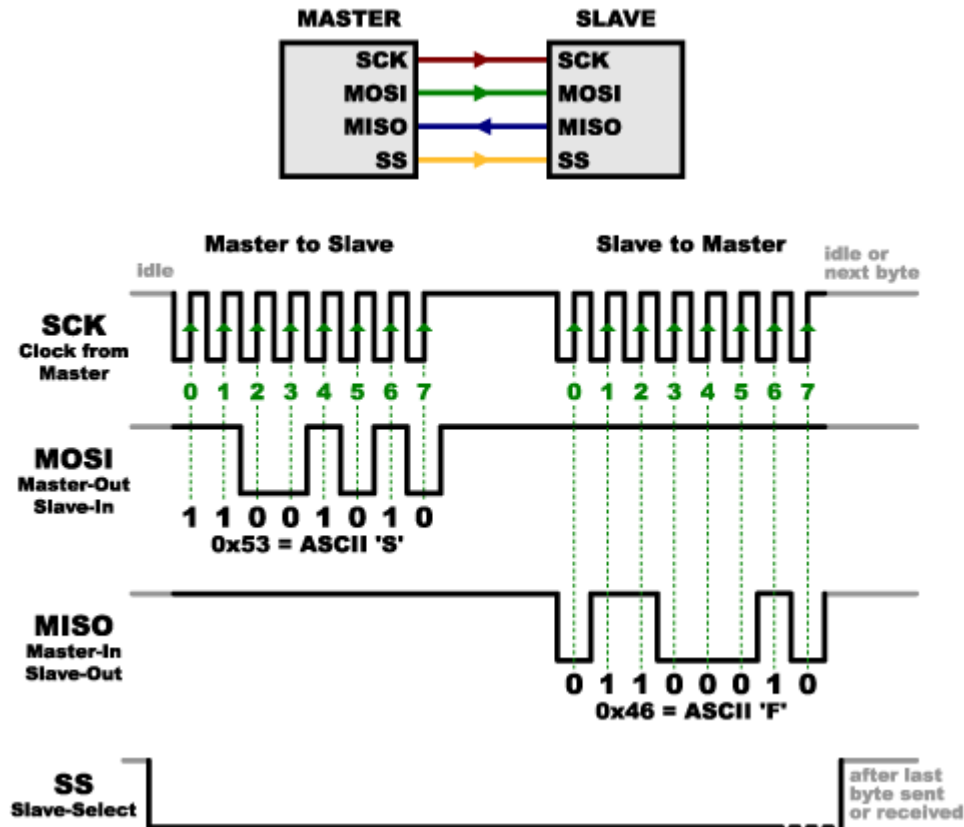
client_socket = socket.socket(socket.AF_INET, socket.SOCK_DGRAM)
client_socket.sendto("0", (szServer, nUdpPort))
client_socket.close()
```

Codis font dels codis d'enviament de datagrames UDP en Python



# Arduino i Raspberry Pi

## SPI



Explicació del bus SPI



# Comunicacions amb Raspberry Pi

## MQTT – Què és?



MQTT és una forma de comunicar dispositius d'Internet de les Coses (IdC / IoT) entre si. És un protocol lleuger i molt versàtil que es pot fer servir des d'un Arduino, una Raspberry Pi, un PC multinucli fins als serveis d'Amazon Web Services.

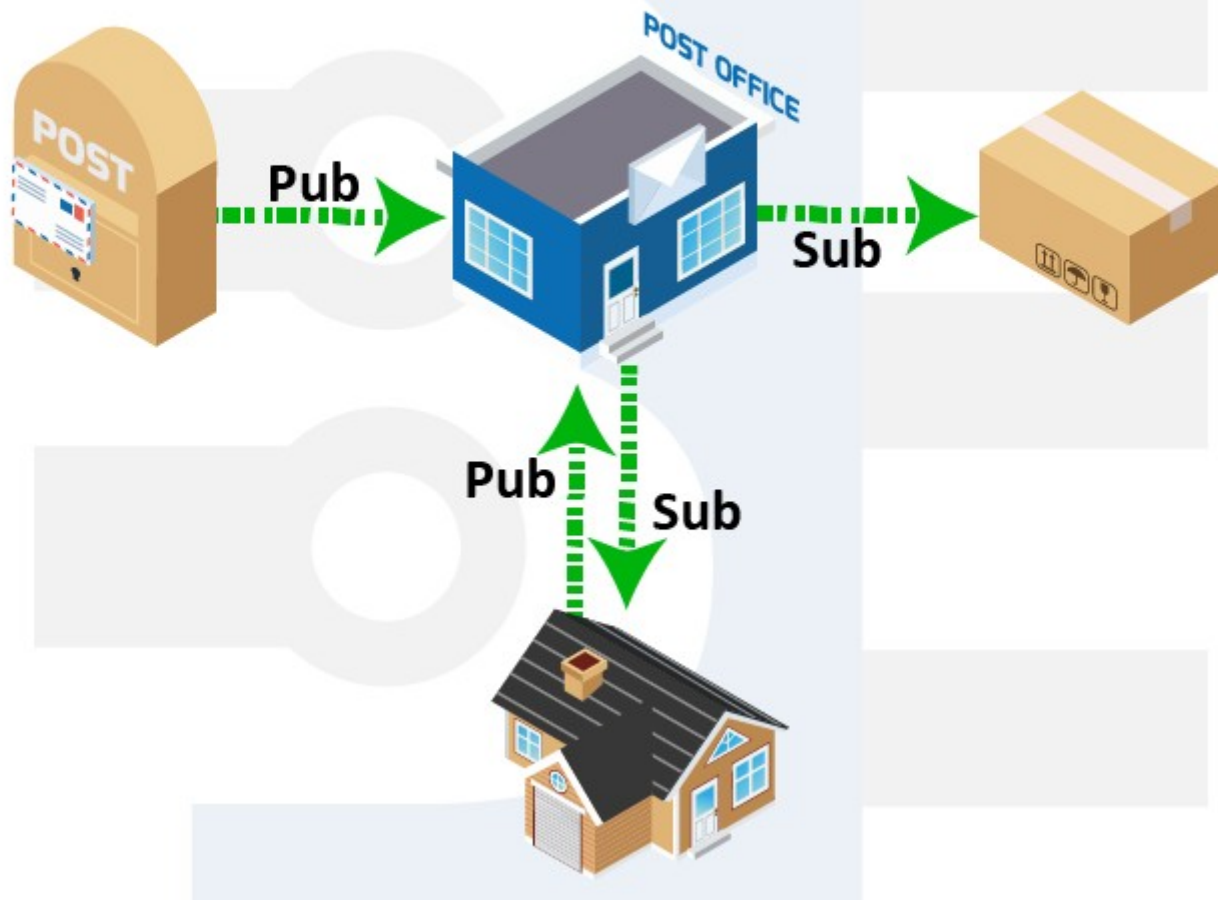
<https://www.baldengineer.com/mqtt-introduction.html>

[http://binefa.cat/php/dam/m09uf3/20170224/2017024\\_mqtt\\_00.pdf](http://binefa.cat/php/dam/m09uf3/20170224/2017024_mqtt_00.pdf)

# Comunicacions amb Raspberry Pi

## Analogia amb el servei postal

mqtt: //broker/topic/message





# e⚙️ Comunicacions amb Raspberry Pi

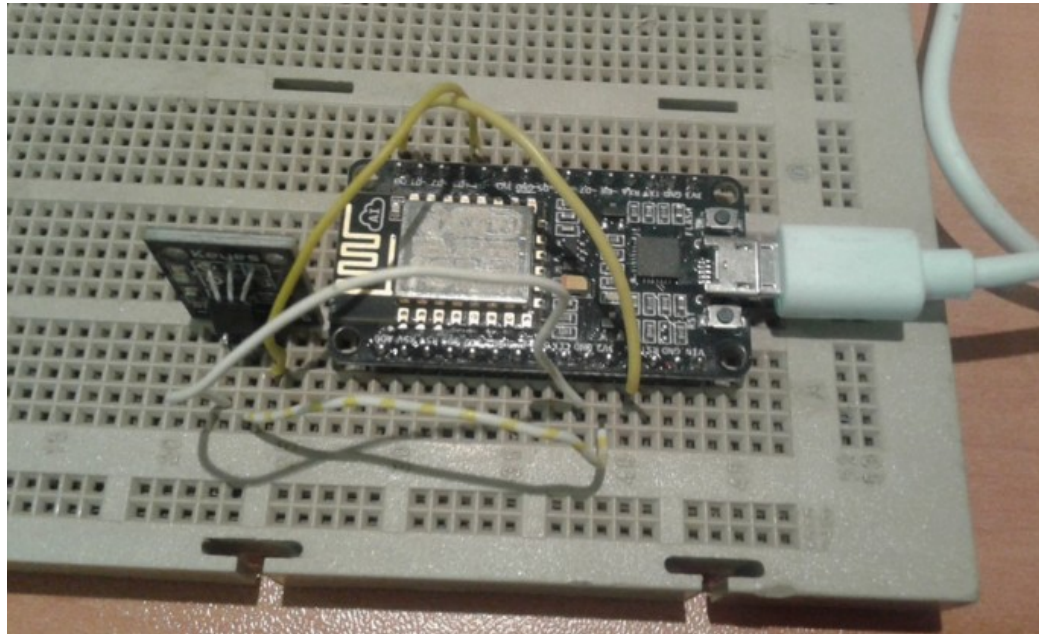
## Perquè no fer servir HTTP (o REST)

HTTP requereix de múltiples accions POST per a distribuir un missatge a més d'un client. L'objectiu del sistema de missatgeria intermediària és que l'intermediari distribueixi el missatge, tan sols als clients interessats. La funcionalitat del MQTT és trametre d'un a molts.



# Comunicacions amb Raspberry Pi

## ESP8266 sobre l'IDE d'Arduino - MQTT



```

Fitxer  Edita  Vi
Client mosqsub/15509-debian8: Entering deep sleep mode for 3 seconds...
Client mosqsub/15509-debian8: Connecting to IoT-eCat
24.94
Client mosqsub/15509-debian8: WiFi connected
25.00
Client mosqsub/15509-debian8: IP address:
Client mosqsub/15509-debian8: 192.168.1.12
24.94
Client mosqsub/15509-debian8: Attempting MQTT connection...connected
Client mosqsub/15509-debian8: Requesting DS18B20 temperature...
25.00
Client mosqsub/15509-debian8: Sending temperature: 24.69
Client mosqsub/15509-debian8: Closing MQTT connection...
Client mosqsub/15509-debian8: Closing WiFi connection...
Client mosqsub/15509-debian8: Entering deep sleep mode for 3 seconds...
25.00
Client mosqsub/15509-debian8: Connecting to IoT-eCat
Client mosqsub/15509-debian8: ...
25.06
~C
acat@debian8:~$ mosquitto_sub -d -t sensors/test/temperature
Client mosqsub/15509-debian8 sending CONNECT
Client mosqsub/15509-debian8 received CONNACK
Client mosqsub/15509-debian8 sending SUBSCRIBE (Mid: 1, Topic:
Client mosqsub/15509-debian8 received SUBACK
Subscribed (mid: 1): 0
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.81
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.75
Client mosqsub/15509-debian8 received PUBLISH (d0, q0, r0, m0,
24.69

```

☒ Desplaçament automàtic

<http://www.jerome-bernard.com/blog/2015/10/04/wifi-temperature-sensor-with-nodemcu-esp8266/>

[http://binefa.cat/php/dam/m09uf3/20170224/esp8266\\_03.pdf](http://binefa.cat/php/dam/m09uf3/20170224/esp8266_03.pdf)

# Torn de preguntes ...





# Arduino i Raspberry Pi

Presentació descarregable a : <http://binefa.cat/blog>

Correu electrònic de contacte : [jordibinefa@electronics.cat](mailto:jordibinefa@electronics.cat)

twitter



<https://twitter.com/JordiBinefa>

<https://twitter.com/electronicscat>



<http://es.linkedin.com/pub/jordi-binefa/13/717/90b>

Plaques disponibles a :

<http://www.electronics.cat>

<http://www.makeit.cat>



**Moltes gràcies per la vostra atenció**