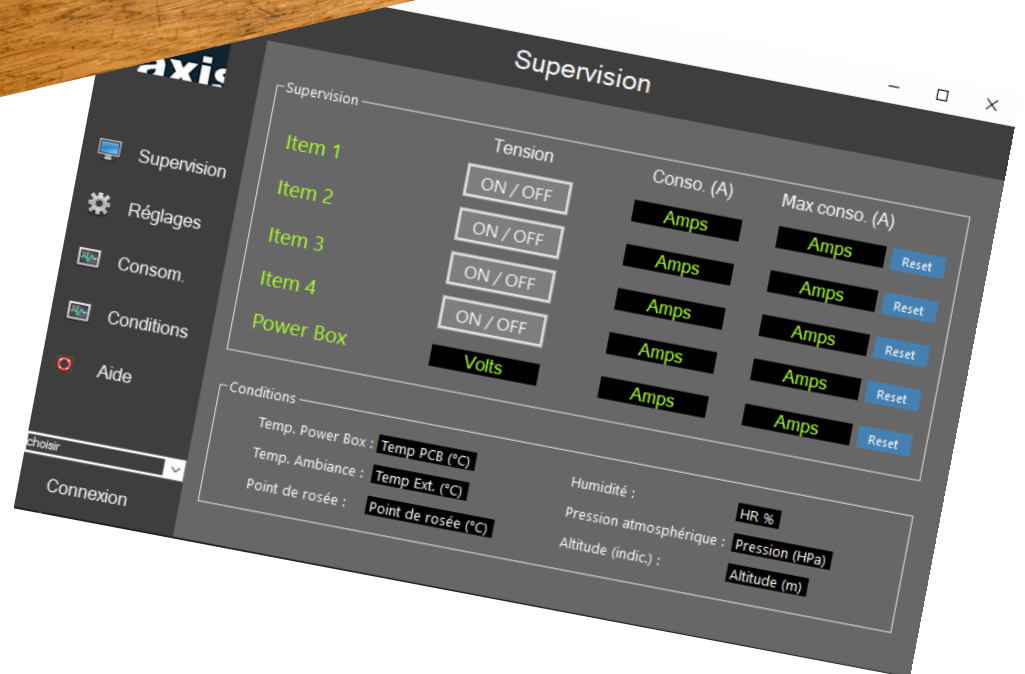


# NEWTHOM POWERBOX V 1.0

## USER MANUAL

– March 2023 –



Electronic manual or remote management of 4 ways of supervised power supplies 12V compatible ASCOM.

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## Introduction

Thank you for choosing to use the NEWTHOM POWERBOX. This device allows you to manage 4 12V switches manually or remotely by monitoring the consumption of each channel. An optional external sensor allows external temperature, atmospheric pressure, humidity and dew point parameters to be monitored.

The advantages of the NEWTHOM POWERBOX are:

- Can be used nomadically or at a fixed station, manually or remotely without changing any connection.
- Manual connections/disconnections are avoided which can cause voltage spikes (ground loop) and damage to electronic devices.
- Can be used without any PC connection, when you are next to your instrument, unlike other PowerBoxes on the market.
- Scalable: The microcontroller is accessible, removable and easily replaceable over time and as changes evolve.
- The 3D files of the housing and control buttons are available in the downloadable elements so that you can 3D print the design that suits you and/or modify them to your liking. An aluminum housing format is also available.
- ASCOM compatibility to use the NEWTHOM POWERBOX via your favorite software.
- Dedicated software, free download, allowing the use, supervision and adjustment of your case in a simple way.

All downloadable elements are available from this page:

<http://www.astrosurf.com/bex/NewthomPowerboxV1.html>

## Compatibility

Windows OS compatibility:

- Windows 10 and later
- Windows 8 / 8.1
- Microsoft .Net Framework 4.7.2

C compatibility ASCOM:

To connect the NEWTHOM POWERBOX via ASCOM as a switch interface it is necessary to install:

1. ASCOM Platform 6.2 or later
2. The NEWTHOM POWERBOX ASCOM Driver

## Quick Start

The NEWTHOM POWERBOX allows you to easily manage your setup when you are outdoors next to your equipment, but also to manage it remotely without having to modify your wiring.

**On-field use:**

The use is simply done with a 12V power supply (prefer a voltage between 13V and 13.5V – see Appendix 6). The management of the switches is then done manually. The selection of a switch is done by pressing the "Select" button (the Led of the corresponding switch then starts to flash for 3 seconds), once selected the press on the button "ON / OFF" activates / deactivates the selected switch .

**Remote use :**

To connect the NEWTHOM POWERBOX and control it via your computer it is necessary to :

1. Plug the RJ45/USB cable into your PC. Your PC (if up to date) should automatically recognize the FTDI chip that will "create" a COM port - If the FTDI cable is not recognized you can download the driver here: <https://ftdichip.com/drivers/>
2. **If you use an ASCOM compatible software** (PRISM, NINA ...) that allows you to control ASCOM switches : just install the NEWTHOM POWERBOX driver and select it in your ASCOM compatible software.
3. **If you want to use the dedicated NEWTHOM POWERBOX application** which allows you to finely supervise all the parameters of your setup: Install the NEWTHOM POWERBOX software and launch the application.

## Hardware

### External views

#### *Top view*

Each LED indicates the status of each of the 4 channels and the main power supply. The brightness of these is adjustable in the NEWTHOM POWERBOX software.

At startup, the LEDs flash alternately and then increase brightness before turning off.

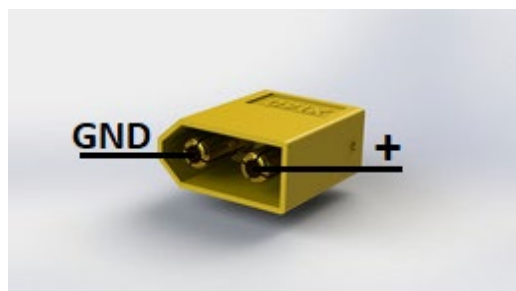
The Com LED is lit as soon as a sufficient supply voltage is detected. This same LED flashes with each request received either by the NEWTHOM POWERBOX software or by the ASCOM-compatible third-party software.

Switch LEDs have the following behaviors:

STATE	MEANING
LED lit	Switches closed (ON)
LED off	Open switches (OFF)
Continuously flashing LED	Manually selected switch
Occasionally flashing LED (switch 4)	Only for switch 4: switch in automatic mode, it can no longer be activated manually or by software, it is regulated according to the risk of condensation
Occasionally flashing LEDs for all 4 switches simultaneously	Alert: housing temperature > 80°C

#### *Front view*

- RJ11 connect: optional ambient sensor (temperature, humidity, dew point and temperature).
- RJ45 connector: FTDI / USB cable for PC connection.
- Yellow XT60 connector for 12V power supply (polarity below). Protection against voltage peaks, against reverse polarity. The minimum power supply to keep all features active is 6V. The maximum recommended power supply is 14V.



#### *View from the back side*

Each switch uses a female plug 5.5mm x 2.1mm. A maximum consumption of 5A (60W) per channel is recommended with a total consumption of 10-12 A (120 W-150W).

Polarity:



Note: The type of enclosure used may be different from the one shown in the images above.

## Consumption of the NEWTHOM POWERBOX

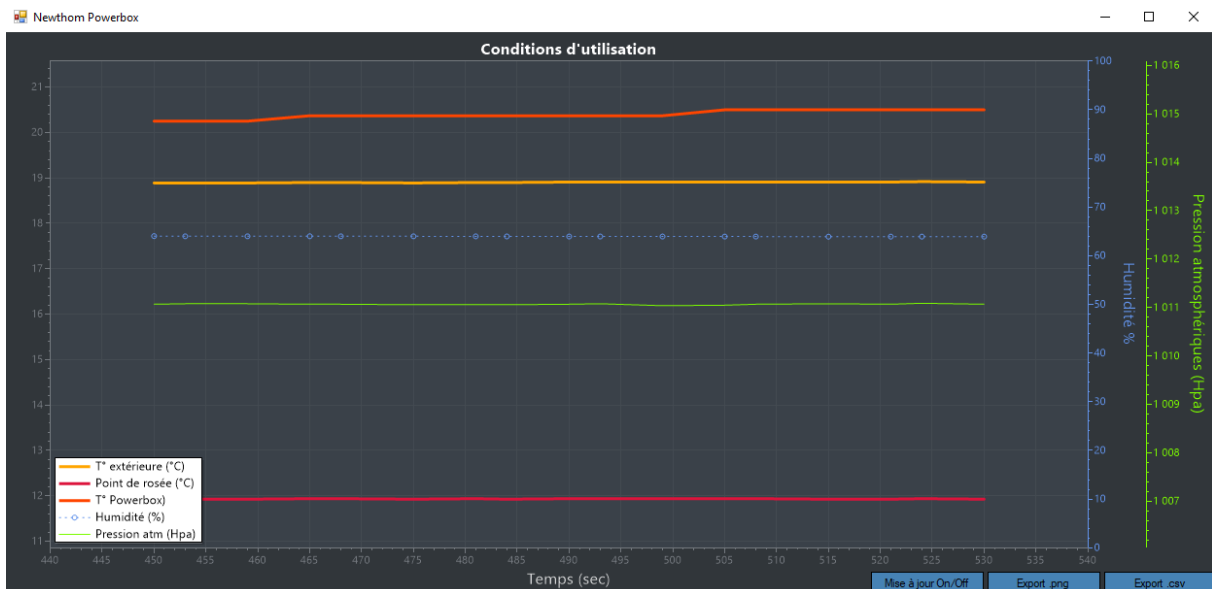
The consumption of the box for its own operation is usually a maximum of 0.06A for 12V or 0.7W.

## Optional external sensors

Note that this is the same external sensor as the NEWTHOM REGULATOR (<http://astrosurf.com/bex/NewthomRegulatorV4.html>). The external sensor must already be connected before powering up the POWERBOX to be used otherwise it will not be recognized. The measurements made by this sensor are:

- External temperature (°C)
- Relative humidity (%)
- Dew point temperature (°C)
- Atmospheric pressure (hPa)
- Altitude (indicative by comparison with pressure in reference atmosphere: 1013.25hPa)

The tracking of these measurements can be displayed in the graphs of the NEWTHOM POWERBOX application and can be exported for data analysis :

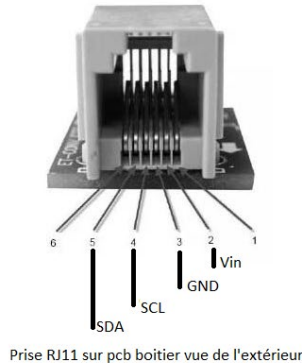


**NB:** if the sensor is disconnected, all values will be displayed at zero. Reconnecting the sensor will require a "Reboot" of the NEWTHOM POWERBOX to reset the sensor.

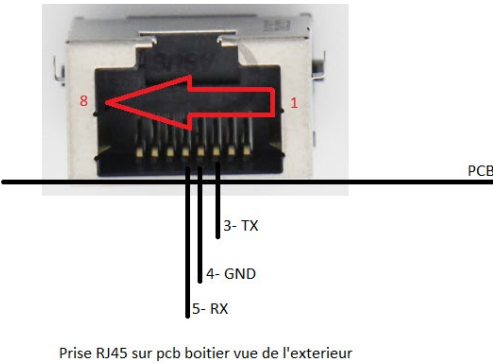
**NB2:** in case of automatic management of switch 4 "AUTO ON / OFF" (see tab Settings), if the external sensor is not present the switch will remain OFF.

Conctors on the housing

For external sensor

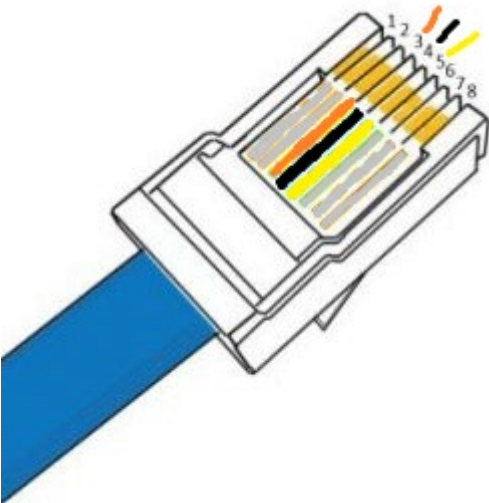
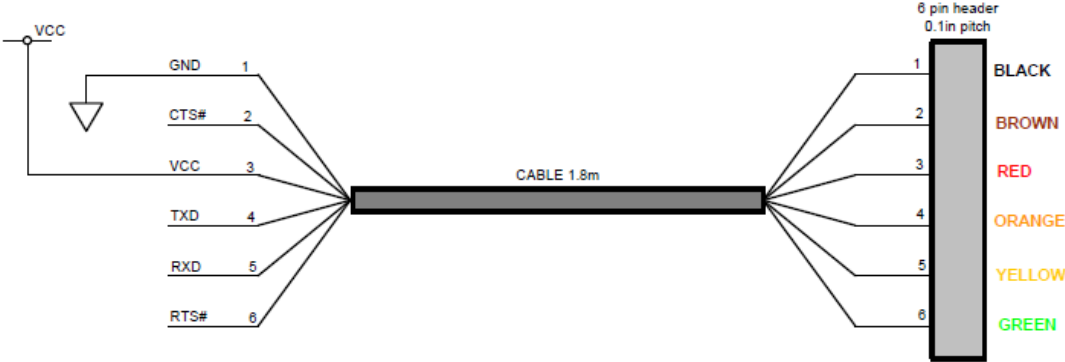


For communication:



USB-RJ45 FTDI cable

The reference of the USB-RJ45 cable is FTDI TTL-234X-3V3-WE (recently replaced by: FTDI TTL-232R-3V3-WE). The color matches are as follows.



- Yellow = RX = 5
- Black = GND = 4
- Orange = TX = 3

The other wires can be connected randomly.



### Direct USB connection to the microcontroller

If you open the case (not recommended!), you will see that the embedded microcontroller has its own USB port (Mini USB). **This port is not accessible from outside the enclosure. This must not be connected at the same time as the main power supply under penalty of deterioration of the control card.** This dedicated USB port for the microcontroller can only be used to update the firmware of the enclosure, which is available for download and requires the appropriate development tools.

### Use without connection – standalone box

The NEWTHOM POWERBOX is designed to be autonomous without requiring special supervision. However, the use of the dedicated Windows application (see Software part) for supervision can be very useful to check and know the consumption parameters of your setup in particular.

### Serial connection for Windows application or via ASCOM driver

The default settings for the serial link are:

- ReadTimeout = 5000;
- BaudRate = 9600;
- Parity = Parity.None;
- DataBits = 8;
- StopBits = StopBits.One;
- Handshake = Handshake.None;
- DtrEnable = false;
- RtsEnable = false;

### Watchdog

Internal monitoring: An internal watchdog system allows the Powerbox to automatically restart (reset) if a process blocks it for more than a minute.

### Thermal alert

If the temperature of the PCB exceeds 80 ° C a light alert is triggered (flashing of the 4 LEDs switches)

## Software

The installation is simply done via a dedicated Installer "Setup-NEWTTHOM POWERBOX". This facilitates eventual uninstallation. It is best to uninstall a previous version before installing a new one.

### "Supervision" tab

La NEWTHOM POWERBOX driver 4 switches. Each switch can be physically controlled using the physical buttons on the box or via software using ASCOM compatible software or the dedicated NEWTHOM POWERBOX software. When the connection is effective, the interrogation of the box (states, measurements ...) and the display update is done every 5 seconds.

Supervision	Tension	Conso. (A)	Max conso. (A)	
Switch 1	OFF	0 A	0,29	Reset
Switch 2	OFF	0 A	0,21	Reset
Switch 3	OFF	0 A	0,24	Reset
Switch 4	ON	0,38 A	0,41	Reset
Power Box	12,07 V	0,38 A	0,41	Reset

Conditions	
Temp. Power Box :	21,87 °C
Temp. Ambiance :	19,62 °C
Point de rosée :	12,31 °C
Humidité :	62,74 %
Pression atmosphérique :	1011,68 hPa
Altitude (indic.) :	13,04 m

COM6

Deconnecter

#### Switch names:

Clicking on the name of a switch allow to change its name.

All switch names are hard-saved in the NEWTHOM POWERBOX and are therefore retrieved when the connection is effective. Connecting your POWERBOX to another software/computer will therefore not require you to re-enter the names of each switch.

#### Measurements:

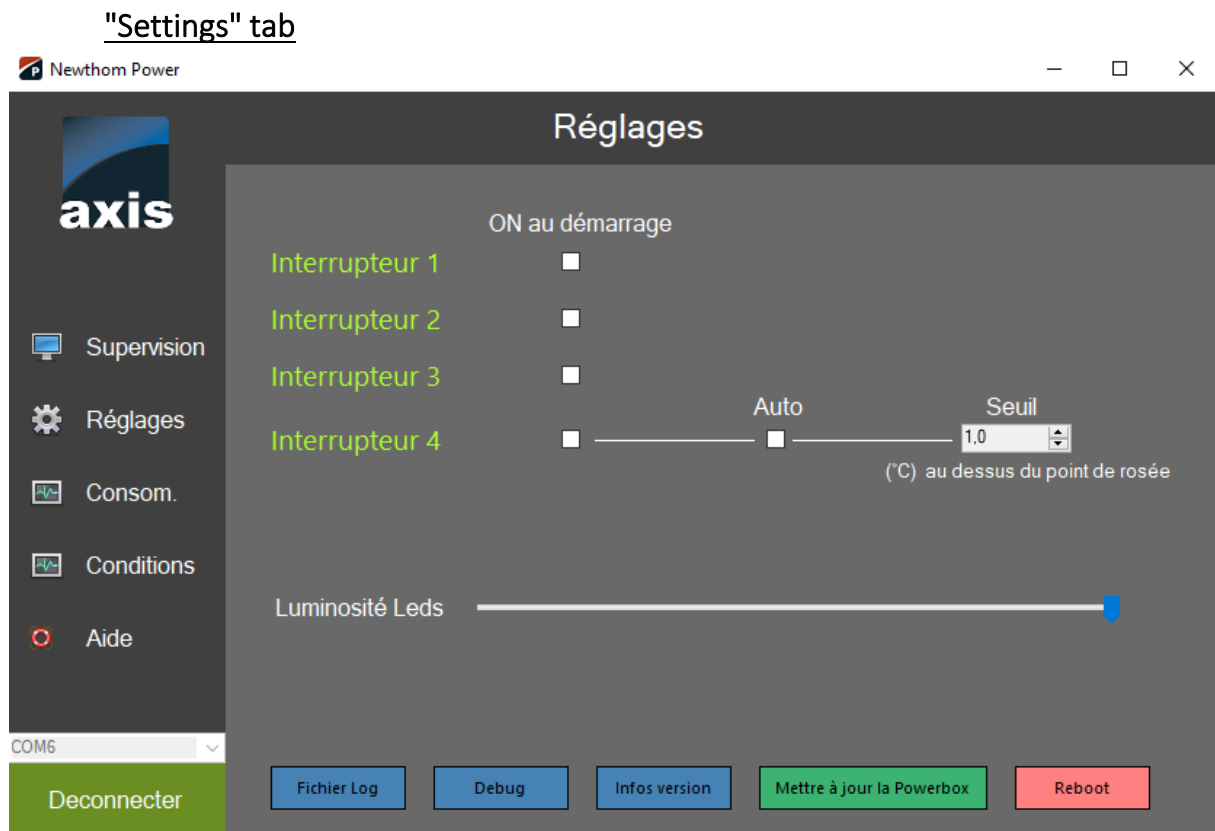
The "Supervision" tab displays the status of the switches, the consumption of each, the cumulative consumption on the entire NEWTHOM POWERBOX as well as all the readings of the different sensors (if external sensor connected). The altitude measurement, when available, is only indicative. It is calculated from a fixed reference pressure at sea level called standard altimeter setting = 1013.25Hpa. The supply voltage measurement is accurate to +/- 5% between 9 and 20V.

Consumption measurements are accurate to about 5% between 0.5A and 10A. For more details see Annex 4.

The dew point is calculated from ambient measurements (temperature and humidity).

#### Connection:

The drop-down menu allows you to choose the COM port to which the NEWTHOM POWERBOX is connected. The connection is via a supplied FTDi cable (RJ45->USB) emulating a serial port. The connection between the PC and the NEWTHOM POWERBOX is checked regularly. In case of disconnection (tearing off the USB cable) the COM port is released by the software and the actual disconnection.



On this tab, the settings are:

- Brightness of the LEDs: the setting dims the 5 LEDs of the box. Note the existence of a red internal LED and a blue internal LED when the box is powered. It remains lit and may possibly slightly tint the LEDs on the surface.
- ON by default: for each switch allows you to choose which one is on ON as soon as the Powerbox is turned on.
- AUTO ON/OFF: only switch number 4 can be set to control a heating resistor. If the "Auto ON/OFF" box is checked, switch 4 will no longer be manually controllable and will automatically turn ON when the difference between the dew point temperature and the outside temperature is below the trigger threshold set on the same tab. Hysteresis is set at 0.2°C.
- "Log file" button : gives access to the software log files folder.

- "Debug" button : opens a communication console with the hardware to query/debug if necessary. See Annex 1 for more information.
- "Version info" button: displays the firmware (if connected) and software references.

#### Note:

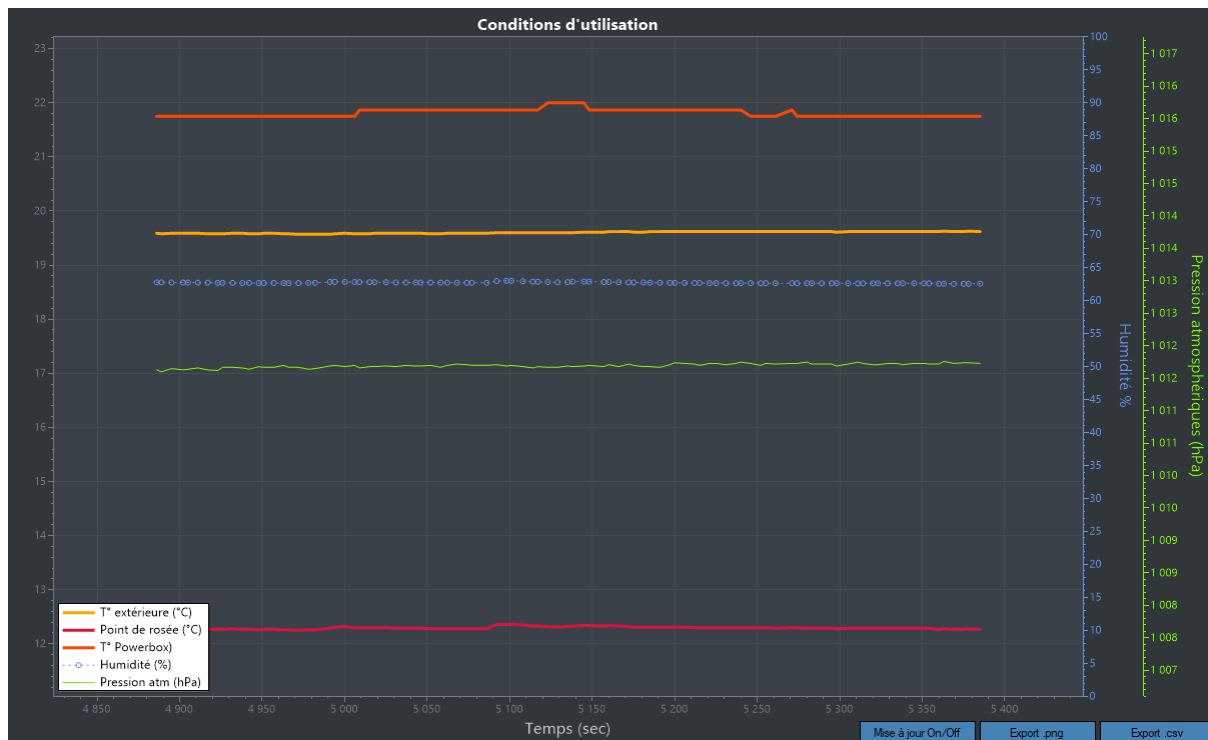
- The data of the "Settings" tab are updated from the hardware each time the "Settings" button of the application is pressed.

### "Charts" tab

The NEWTHOM POWERBOX allows, in a few clicks, to analyse the measured data without having to use another software to display graphs. The data is recorded by the NEWTHOM POWERBOX app when the box is connected to it. When logging out, the data is erased. However, this data can be saved via the "Export .csv" button on each chart or in png format via the "Export .png" button.

#### Examples charts:

Monitoring of observation conditions:



Monitoring of the main voltage and consumptions:



### "Help" tab

Opens the webpage dedicated to the NEWTHOM POWERBOX with all the elements to download.

### Boxes

The 3d files of the boxes are available for download so that everyone can customize their NEWTHOM POWER BOX. Some examples below:



## Troubleshooting

In case of instability of the enclosure (reboot):

- Verify the stability of the 12V power supply (do not hesitate to go up to 13.5 V).
- If the reboot is done every minute, the watchdog is certainly responsible (see watchdog in this document).

In cas of difficulty of connection PC-Powerbox :

- Check the correct installation of the FTDI driver and the presence of a corresponding COM port in the device managers at the time of USB connection.

In case of difficulty connecting PC-external sensor:

- The external sensor must be connected when powering up the NEWTHOM POWERBOX. Do a "reboot" in the "settings" tab once the external sensor is properly connected.

## APPENDIX 1 – DEBUG CONSOLE

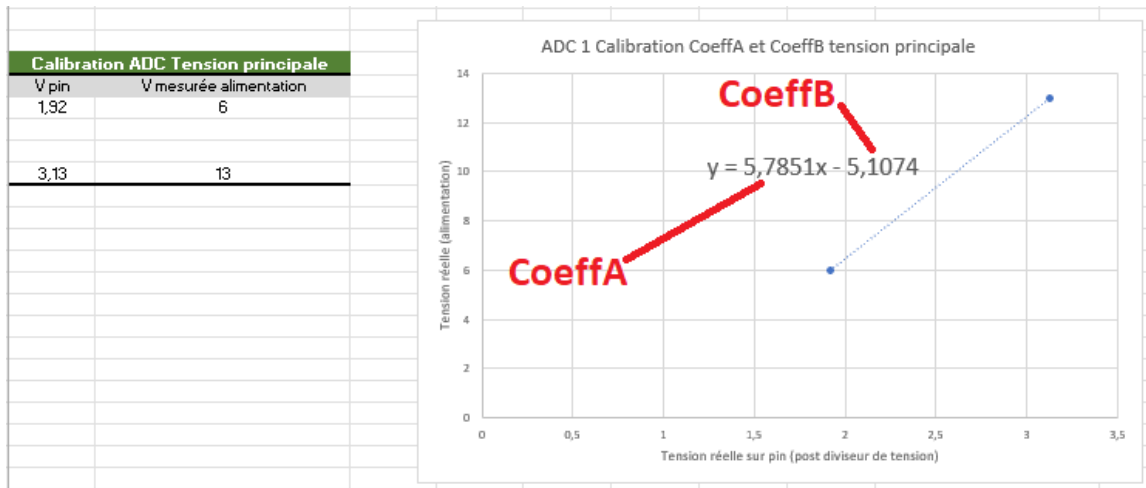
Commands that can be used for the debug console

<b>Order sent</b>	<b>Expected return</b>
GETSTATE #	Case condition + measurements
C #	COK = OK connection
SCANI2C #	Address of connected sensors
GETADC #	ADC measurement parameters
SETADC #	Return of calibration elements recorded for voltage measurement (see Annex 2)
SETCURRENTCOEFFA #	Return of the calibration coefficient A recorded for current measurement (see Annex 3)
SETCURRENTCOEFFB #	Return of the calibration coefficient B recorded for current measurement (see Annex 3)
MEMORYUSE #	Amount of free memory available
GETSETUP #	Case settings

## APPENDIX 2 – Calibration P protocole – Voltage measurement

Each card has its own internal resistance. The calibration of the ADC is made for each enclosure but can be modified using the following procedure:

- Use the "Debug" button on the "Settings" tab, open the communication console.
- The following command is used to retrieve all useful measurements: GETADC #
- Turn off all switches (OFF)
- Set the supply voltage between 6 and 9V
- Enter the console: GETADC #
- Read the ADC measurement: voltage pin VP = measure 1
- Set the supply voltage between 12 and 13V
- Enter the console: GETADC #
- Read the ADC measurement: voltage pin VP = measurement 2
- Make the regression curve of the ADC in excel by displaying the linear regression curve and the equation of the corresponding affine function. Like what:



- Adapt the variables by sending them to the box with the following command line, replacing "coeffA" and "coeffB" with their value:

**SETADC#coeffA#coeffB#**

In our example the command would be: SETADC#5.78#-5.10#

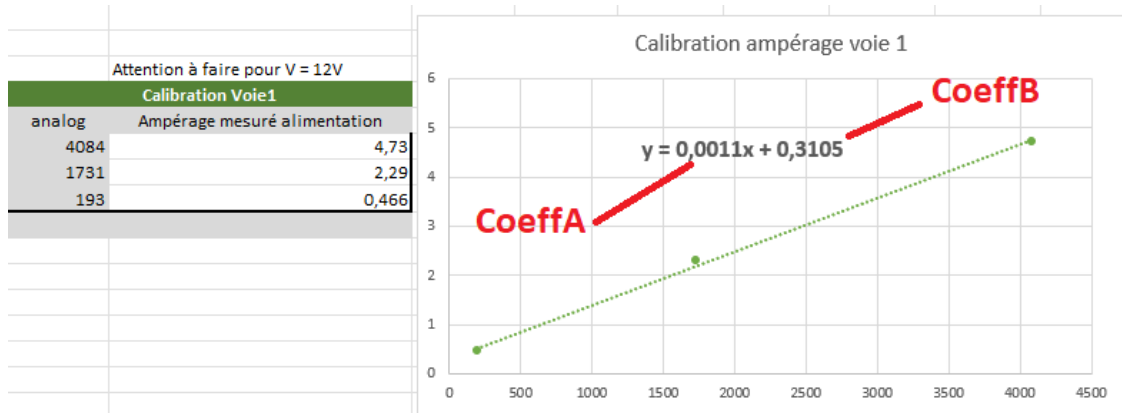
- An update message is displayed in the debug console.



## APPENDIX 3 – Calibration protocol – intensity measurement

Each card has its own internal resistance. The ADC setting is done at the factory but can be changed using the following procedure:

- Use the "Debug" button on the "Settings" tab, open the communication console.
- The following command is used to retrieve all useful measurements: GETADC #
- Set the supply voltage to 12V
- On the housing, turn on a switch (ON) with a load plugged into
- Record the current (**I1**) consumed by this load (power indication) taking care to correct the consumption of the case under load
- Enter the console: GETADC #
- Read the ADC's analog measurement corresponding to the switch, for example:
  - Analog 1 (V1): XXX = **analog 1**
- On the same switch, change charge to have a different consumption and turn on the switch
- Raise the current (**I2**) consumed by this load (power indication) taking care to correct the consumption of the case off load
- Enter the console: GETADC #
- Read the ADC's analog measurement corresponding to the switch, for example:
  - Analog 1 (V1): XXX = **analog 2**
- Make the regression curve  $f(\text{analog})=I$  in excel by displaying the linear regression curve and the equation of the corresponding affine function. Like what:



- Adapt the variables by sending them to the box with the following command line, replacing "coeffA" and "coeffB" with their value:

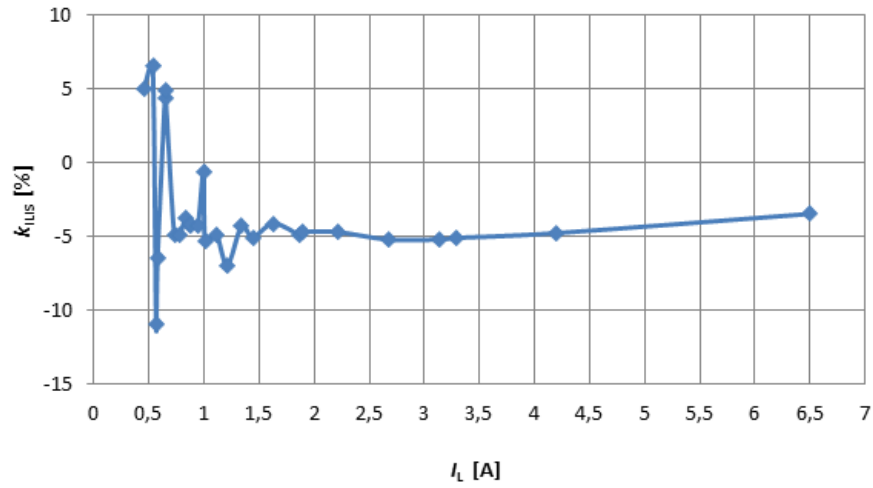
**SETCURRENTCOEFFA#coeffA#**

**SETCURRENTCOEFFB#coeffB#**

In our example the command would be: SETCURRENTCOEFFA#0.0011# then SETCURRENTCOEFFB#0.3105#

## APPENDIX 4 – Accuracy of intensity measurements

According to the datasheet, the variation in precision as a function of intensity (per switch) evolves as follows (Kilis = ratio between intensity consumed and ADC pin reading):



## ANNEX 5 – Thermal behaviour

The following graph shows the evolution of the PCB temperature as a function of the charge level. The readings are made via the thermal sensor placed on the PCB (orange curve):

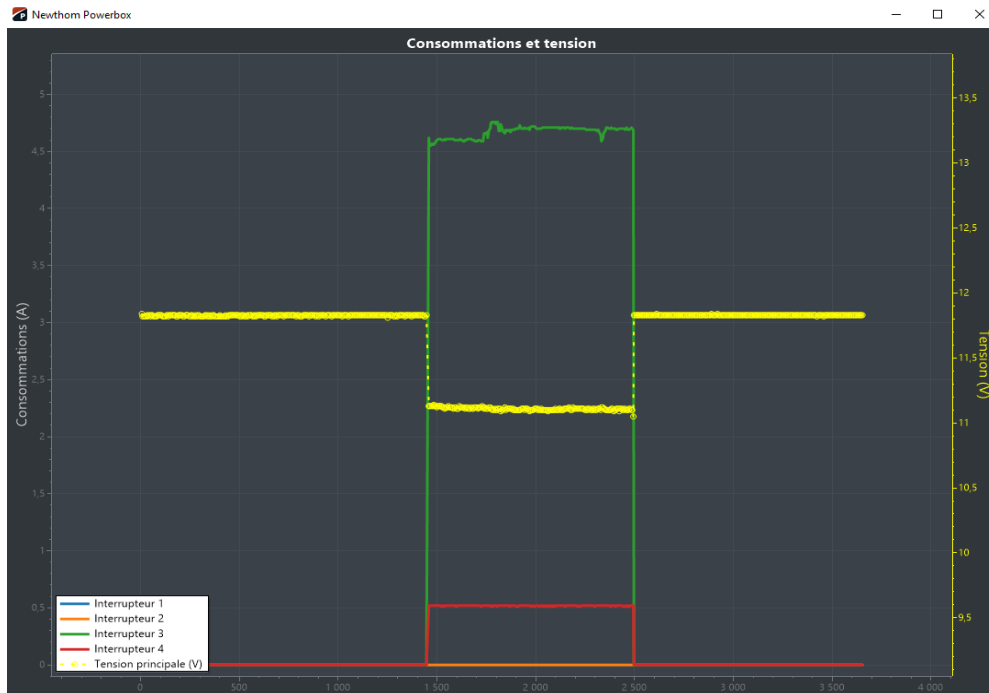
- Period 0-1500 sec: a zero load. 12V power supply; All switches off.
- Period 1500–2500 sec: 5.2A of load at approximately 12V. for a temperature rise of 6°C



**NB:** the voltage drop is due to the use of heating resistors for testing.

## ANNEX 6 – Supply voltage evolution

Depending on the quality of your power supply and the amount of current used by the different loads of your setup, the main voltage may decrease. It is often advisable to use a voltage above 12V, typically 13.5V to counteract these effects. Below is the evolution of the current with a load of about 5.2A with a laboratory power supply set to 12V. A decrease in voltage of 0.8V is noted.



Below is the evolution of the current with the same load of about 5.2A with a laboratory power supply set at 13.5V. A decrease in voltage of 0.8V is noted but allows to maintain a main power supply beyond 12V.

