



ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

ATC - COMMUNICATION INTERFACE
USER MANUAL

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JUNE 13, 2021

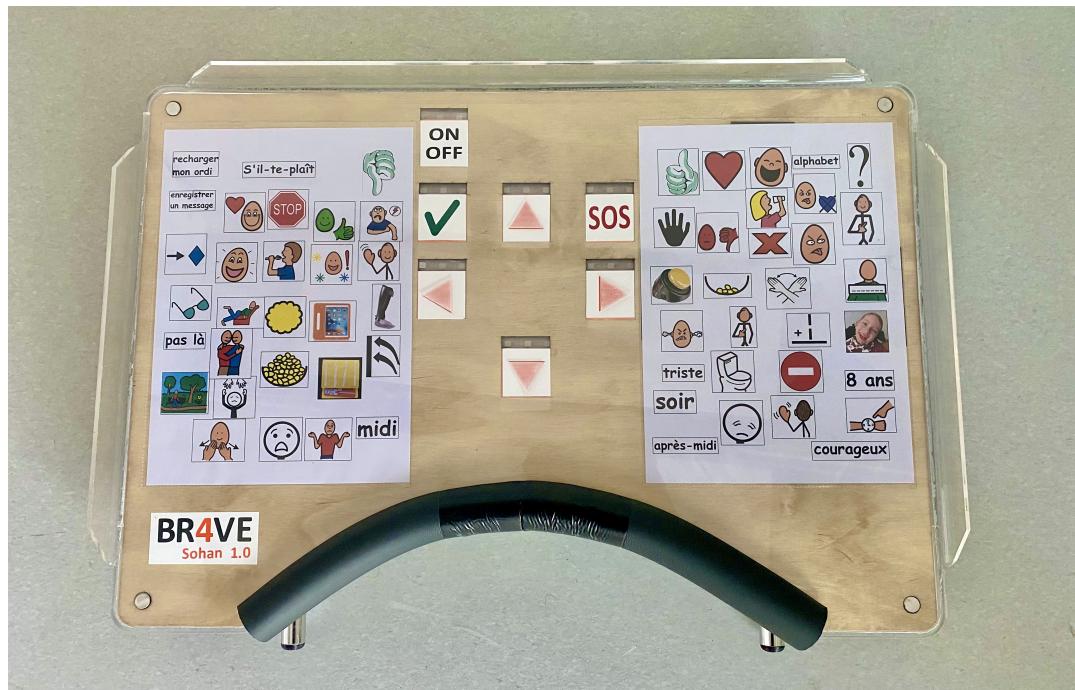


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I Introduction

This device has been developed in the context of The Assistive Technology Challenge. The communication interface is designed for a child unable to speak but eager to interact and communicate with his peers and his environment. It provides autonomy and an efficient communication tool. The communication can happen in two ways: firstly, the user can communicate with people close-by, by pointing pictograms placed on the board. Secondly, the user can use the controller part of the device to scroll through the Grid3 software running on a computer, via a Bluetooth module.

The device is easy-to-use and requires as less effort as possible. It meets the safety requirements and is made of biocompatible materials to ensure the safety of the user in his everyday activities.

Finally, the device is completely open-source. A picture of the device is presented in the front page.

II Warnings !

Those precautions need to be considered very carefully in order to avoid any harm to the user:

- Do not splash the device entirely into water.
- Avoid Exposing the device to very hot temperatures, as well as placing hot plates on the device.
- Do not try to modify or fix by yourself the electronic elements. Call the support given below instead.

In any case, do not hesitate to contact the responsible members for any problem caused. Here is the contact link: <https://www.hackahealth.ch>

III Safety requirements

Water proof: A water droplet cannot damage the device. The device is splash proof. The electronics are isolated from the user and cannot be damaged by spilled water. If water or another liquid is spilled on the device, just wipe it away.

Shock resistant: The device is resistant to small shocks and impacts. The materials are made to be solid and shall not be damaged nor broken easily.

Electronics: The wires and electronic components are protected and hidden from the user. All electronics are either placed in an isolated box or hidden into the device. The electronics can not harm through overheating. Since the device cannot be connected to a wall plug when in use, there is no risk of electrocution for the user.

Non-irritating: The cover window used as interface between the user and the device is not irritating, the user will not hurt himself while using the device.

Weight resistant: The device can support the weight of the user even when lying on it.

IV Structural description

| Piece | Support | Cover window | Electronic box | Pictograms | Capacitive sensors |
|-----------|------------|--------------|--------------------|--------------|--------------------|
| Materials | Birch wood | PMMA | 3D printed in PETG | Paper sheets | Copper sheets |

Electronics: Arduino Nano, Power bank, Bluetooth module, MPR121, LED strip, buzzer

V Features compatible with the device

Wheelchair Fixation

The device is designed to be mounted on a wheelchair. The user can easily slide the two bars present in Figure. 1 (a), into the tubes allocated for that purpose. The position of the bars can be adjusted by using the screws.(see (a) and (b) on Figure 1).

Computer: Bluetooth Connection

The device has a Bluetooth module made to be connected to a computer or tablet.

Grid3 software and executable file download

The Grid3 software should be installed on the computer the device will be connected to.

Link to download this software: <https://thinksmartbox.com/download-grid-3/>

Also download the following executable file: https://github.com/EugenieChabenat/ATC_communication_interface

VI Operating instructions

First-time use

- Power supply:** For the first use the device needs to be charged. A power bank, placed into a box (see (c) on Figure 1) manages the power supply. Remove the power bank from the electronic box as shown on the Figure 3 and plug it into a power outlet. When fully charged, put it back into the electronic box and insert it back into the device.

The power bank has an autonomy of 5 day if used for 5 hours a day. It means that the device can be used all day without having to be charged, and the power bank can be re-charged at night.

- Turn on the device:** Using the switch button illustrated as (d) on Figure 1, turns on the device.
- Bluetooth connection to the computer:** The device can be connected to the computer where the software is running via Bluetooth technology. Once the device is switched on, it should be detectable by the computer. Go to the Bluetooth settings and select the device *HC-05*. The computer will ask for the password which is *1234*.
- Set up Grid3:** On the computer, open the Grid3 software. You should go to the settings side bar and reach the access menu. From there you will have to assign five different switches to the four orientation keys of the keyboard and the Enter button. You also need to activate the control of Grid 3 using a joystick mode. (Settings/Access/Switches/Activation)
You can follow the below sketches of the Grid Window to have the right order of assignment and setup correctly the switches. (Figure. 4 and 5 in Annexes)
- Using the device:** Please see next section for everyday use.

Daily use

- Make sure that the power bank (shown on Figure 1 as (c)) is fully charged. If not, please refer to the *First Utilization* section for instructions.
- Turn on the device:** Use the switch button, placed on Figure 1 (d) to turn on the device. If the device has turned on correctly, a LED placed next to the switch button will also turn on.
- Check Bluetooth Connection:** As requested in *First Utilization* section the device should have already been connected to the computer by Bluetooth. If this has been done it should be detectable and connected automatically. It is recommended to check that the two devices are well connected.
- Run Executable file:** Double click on the file you downloaded earlier.
- Open Grid3:** Double click on the Grid3 software to launch it.
- Use the controller:** By touching one of the arrows (shown as (g) on Figure 1, the user is able to control the computer it is connected to, and to move the cursor on the screen. The controller is composed of 4 arrows, one for moving in each direction: up, down, left and right. When one of this button is selected, a visual feedback is activated, the LEDs at the top of the button are turned on.

The "*enter*" button, located on the top right of the controller part of the device, allows to validate a selection on the computer. Its selection is also confirmed by the use of a visual feedback.

The "*SOS*" button is located on the top left of the controller part of the device. When touched, a sound is emitted (buzzer) which allows to draw attention or ask for help when peers are present in the surroundings.

To be selected, the user needs to stay 1 seconds on the sensor. The activation of a button allows to move of one step in the selected direction. However, when keeping the finger pressed more than half a seconds, the sensors activate the scrolling mode and displacements in chain can be made by staying on the sensor. By security, if the user stays more than 5 seconds on the pictogram the command will stop.

If the user's hand is placed onto multiple sensors, then the sensor that is in the top right will be selected, because it takes into account that the wrist or arm of the user can activate sensors too. These control values can be modified at any time by the user through the executable provided.

7. Use the pictograms: Apart from the controller, the rest of the device is composed of sheets of pictograms that can be used for communication with a person close-by, by pointing at them with the finger (illustrated on Figure 1 as (f)).

8. Power Off: Use the switch button, placed on Figure 1 (d). The LED light will turn off.

Setting up/changing the pictograms : The transparent layer labeled as (e) on Figure 1 is fixated to the device using magnets, and can be removed carefully. Then the sheet of pictograms (see(f) in Figure 1), embedded in a plastic pouch, can be removed and changed. Once done, just place the new sheet of pictograms into the plastic pouch, place it back onto the support of the device, and place the cover window back on top as illustrated (2).

VII Problem solving

Lack of power supply: Check that the power bank is fully charged. If the autonomy of the power bank comes to decrease, another similar power bank, of 5V, can be placed in the device while the other one is charging. The device is made such that the user will never have to use it while it is plugged into an outlet.

No Bluetooth connection: Check the device connection with your electronic tablet or laptop. Verify in the list of the devices that the Bluetooth (BT) module is connected as a Standard Serial over Bluetooth link (COM...). This verification can be done by accessing the device window following this path Control Panel/Hardware and Sound/Devices and right click on your moduel HC-05. (Figure.6 in Annexes)

Reconnect the module if it's not yet connected.

In other cases where you won't be able to reach the device by Bluetooth connection, you can plug in the additional cable to use it directly on the laptop.

Grid 3 is not working: Make sure that the Grid3 software has all updates installed. If necessary, delete and re-download it on your computer, then set it up again, see *First-time use* section.

LED lights do not turn on: Make sure that the device is on and the power bank is charged. If it still does not turn on, try contacting an engineer from the HackHealth team by going on the following website : <https://www.hackahealth.ch>.

One sensor does not work anymore: Make sure that the device is on and the power bank is charged. If it still does not turn on, try contacting an engineer from the HackHealth team by going on the following website : <https://www.hackahealth.ch>.

Spilling liquid while changing the pictograms: Wipe the liquid with a tissue, make sure everything is dry. Then replace the cover window, and switch the device on.

How to clean the device: The external part of the device can be cleaned with ordinary cleaning products.

A fixation is broken: If one of the fixings under the board breaks, it must be replaced. To do this you need to remove the nut that holds it to the board and also the screw that tightens it around the tube. Take a replacement part (or 3D print a new one), insert the tube and screw it onto the board. The screws should not be tightened hard, just enough to feel that the clamp prevents the bar from moving.

VIII Annexes

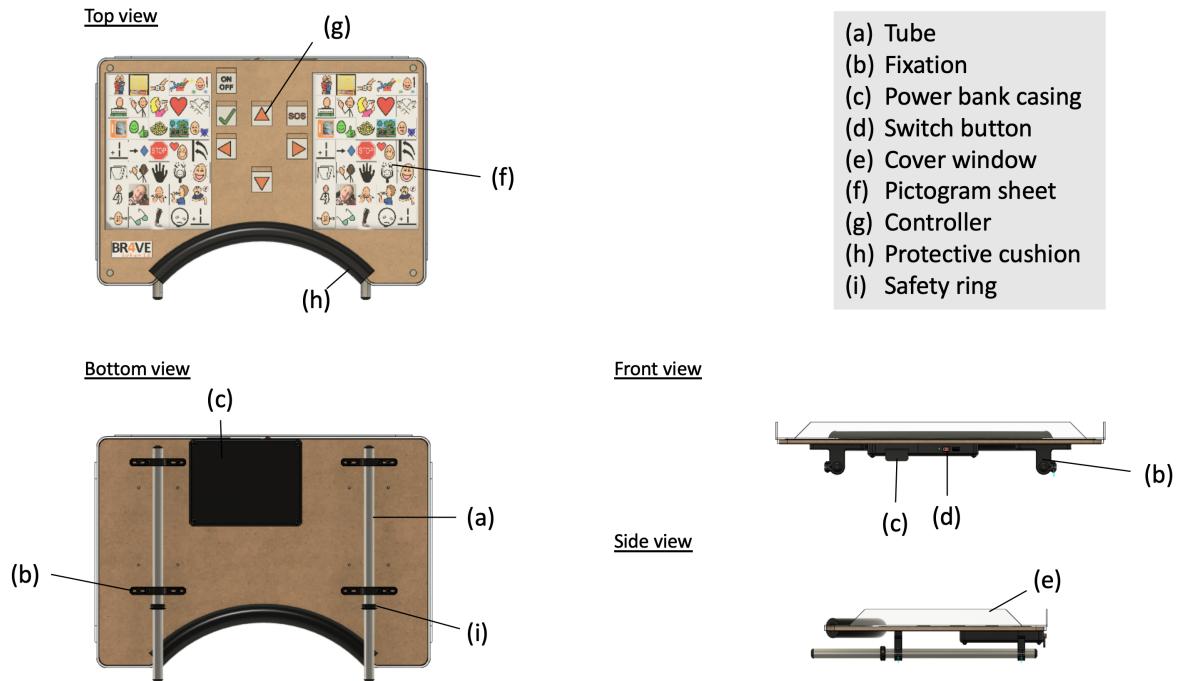


Figure 1: Designed product with labels

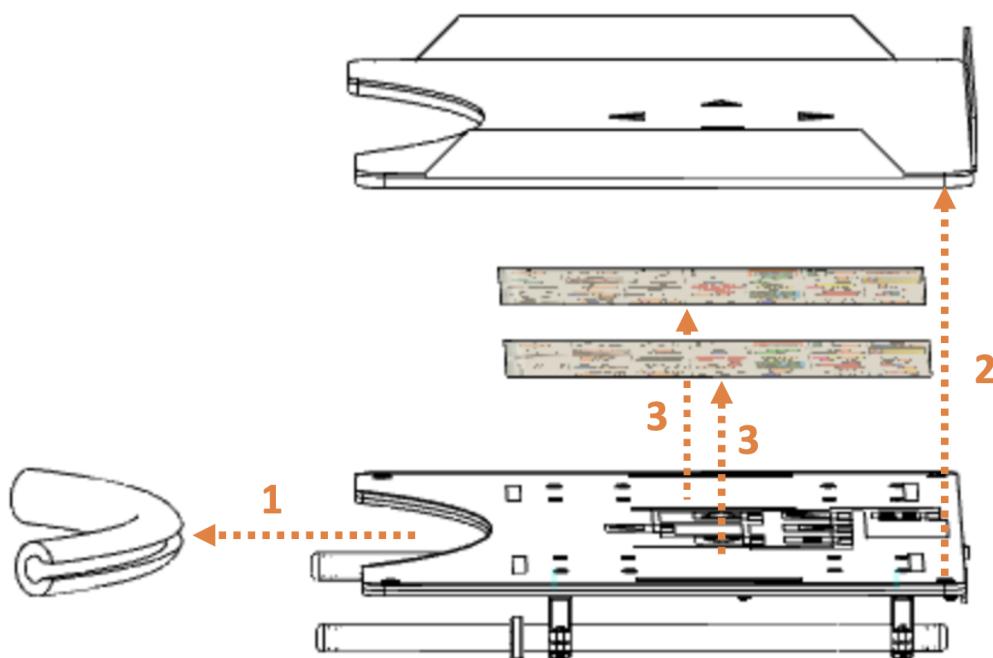


Figure 2: Procedure to change the pictograms

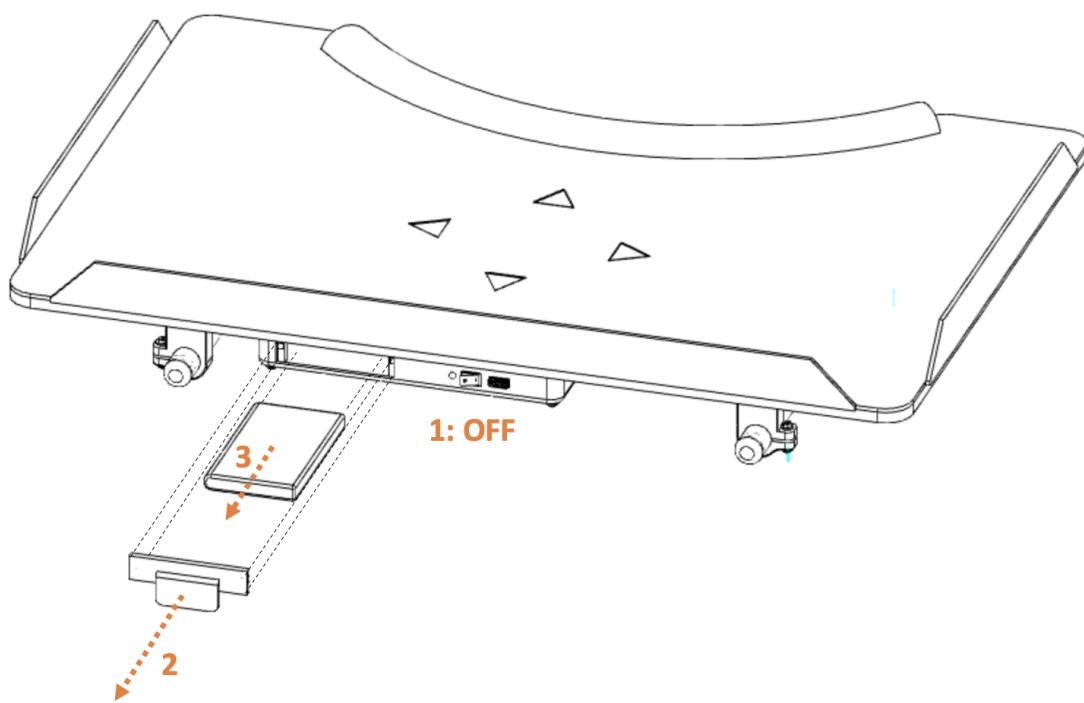


Figure 3: Procedure to remove the power bank

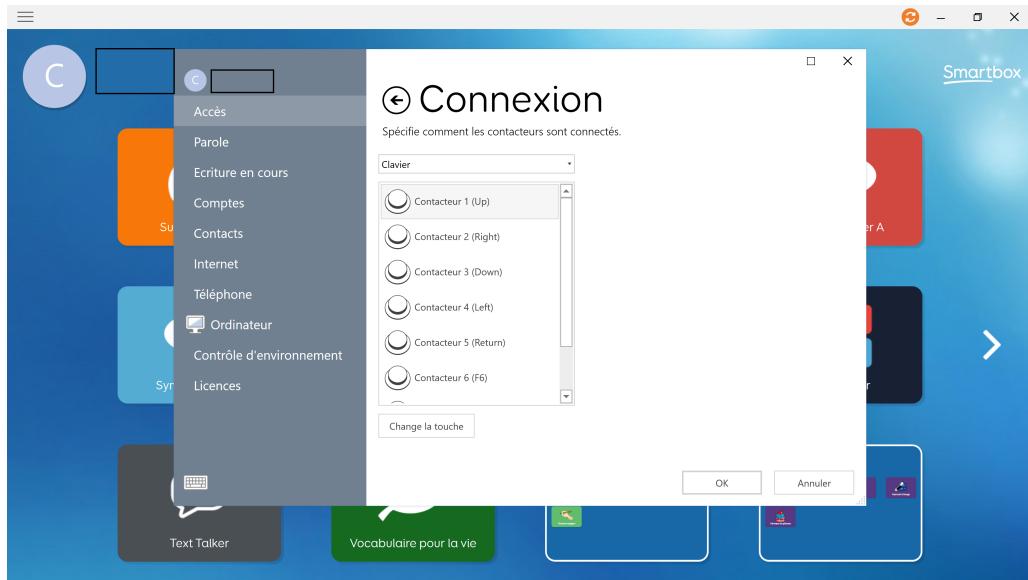


Figure 4: Acces panel of Grid3

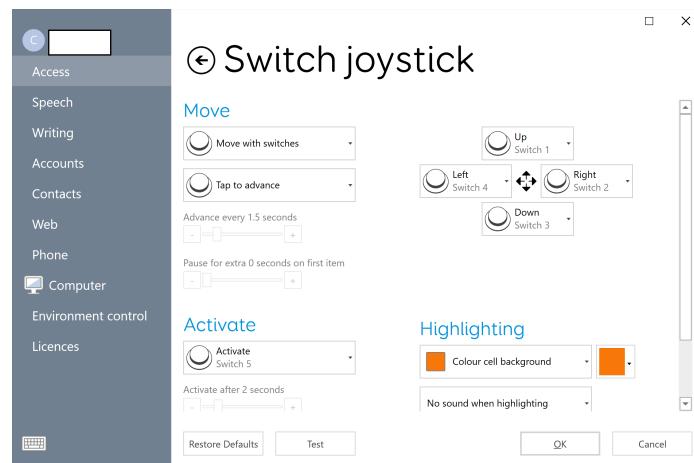


Figure 5: Activate the joystick mode and define the switches function

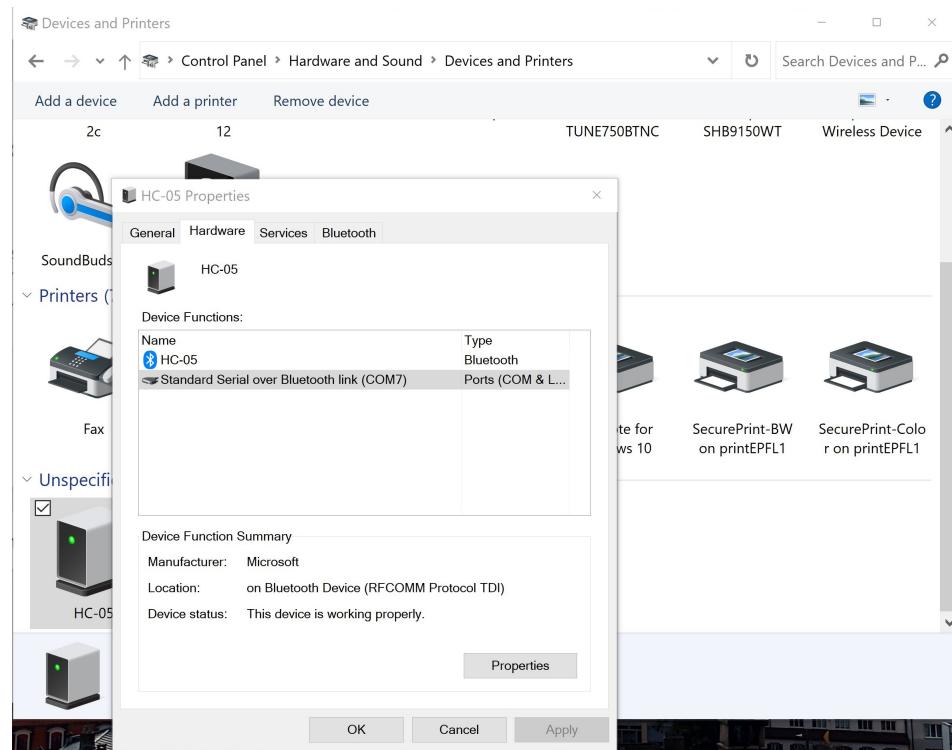


Figure 6: Type of device communication