

FABI - Flexible Assistive Button Interface



User Manual

AsTeRICS Foundation

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Welcome to FABl

FABl - the "Flexible Assistive Button Interface" - makes it possible to connect several momentary switches (buttons) to a computer or a tablet / smartphone. Pressing a button can trigger desired keys on the keyboard or carry out mouse cursor actions. A configured FABl module can be used with any computer (Windows, Linux or Mac) without installing special software, because the FABl module behaves like a normal computer mouse or keyboard when it is connected to the computer. People for whom conventional input devices are not suitable can play computer games, surf the Internet, write e-mails and much more.

The FABl interface can be used with arcade buttons, assistive switches or self-made electrical contacts. FABl consists of a hardware module (an inexpensive microcontroller that functions as a computer mouse or keyboard) and a graphical configuration interface ("FABl-GUI") for setting the desired functions.

FABl is available as an open source kit (including the corresponding assembly instructions for the hardware) and was developed as part of the AsTeRICS Academy project at the UAS Technikum Wien. In 2017, the non-profit organization AsTeRICS Foundation was founded in order to further develop such technologies and systems and make them available to the public, see:

www.asterics-foundation.org.

All software modules, the hardware design files and the documents for the instructions are available under free and open source licenses and can be used and modified free of charge. We have tried to select the most cost-effective components for the desired functions - which makes FABl the most cost-effective push button interface in the currently known universe!

About this guide

These instructions serve to explain the configuration interface and the possible settings and functions. The assembly instructions can be found in a separate document.

In order to set the desired functions through the FABl-GUI, it may be necessary to install a driver (the driver installation is explained in this manual).

Introduction

The "FABI-GUI" configuration software is required in order to be able to define the functions of the buttons. After a configuration has been saved in the FABI system, it is retained there and the FABI system can be used to control various devices (e.g. Windows PC, Mac computer, tablet or smart phone with USB connection.)

The configuration software is only required again when settings are to be changed.

Download and install the software

The executable file FabiGUI.exe can be downloaded from the AsTeRICS GitHub directory:

<https://github.com/asterics/FABI/releases/latest>

Save this file in a desired directory on a Windows PC or laptop.

In principle, the FABI-GUI software can also be started under macOS or Linux, with the help of the "mono" software, which can be found here: <https://www.mono-project.com/download/stable>

After the FabiGUI.exe file has been downloaded from the above-mentioned source, start the application by double-clicking it. If an error message appears, the "Microsoft.Net Framework" is probably not installed on your computer. In this case, download the framework from the following website:

<http://www.microsoft.com/en-us/download/confirmation.aspx?id=17718>

Connect the USB micro cable

Connect this end to the FABI module. Be careful when plugging in, the socket on the microcontroller is not very stable.



Connect the USB plug to the computer. Smartphones / tablets can be connected via a USB-OTG adapter.

Then a COM port with a certain number (e.g. COM4) should be selectable in the FabiGUI software in the selection box "FABI Port" (see Figure 1). After unplugging the FABI module, the COM port should disappear again. If no new COM port is created by plugging in the FABI module, please install the Arduino software from the following source and then try again:

<https://www.arduino.cc/en/software>

If you have any questions about the download or problems installing the software, please send us an email to: office@asterics-foundation.org

Using the FABI-GUI application

After the FabiGUI.exe application has been started, the following window should open:

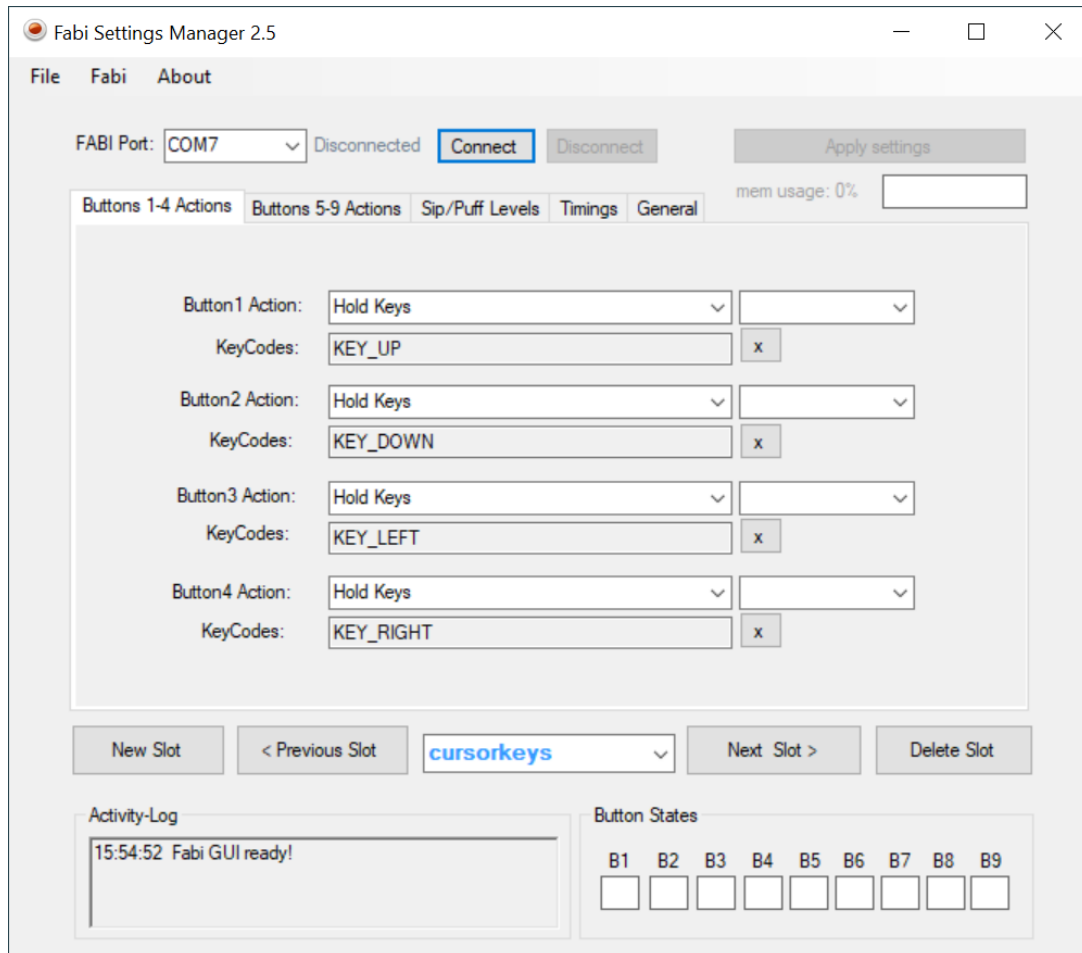


Figure 1: FABI GUI user interface

Connect the FABI device:

To use the functions of the configuration software, follow the steps below:

1. Make sure that the device is connected to the computer with a USB cable.
2. Select a **COM port** and click on the "**Connect**" button on the right side of the selection box. Once the device has been successfully connected, a dialog will appear on the screen showing the device version and allowing you to load the current settings from the FABI device. If you want to do this, click "Yes" - otherwise the suggested default settings will be retained (see Figure 2).
3. If the dialog is not displayed, please select another COM port in the selection box and press "Connect" again.

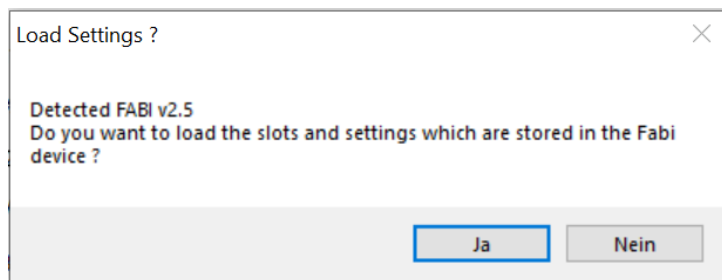


Figure 2: The program has been successfully connected to the microcontroller port

Port status

The port status next to the selection box for the FABI port (top left) shows whether the device is currently connected to the application or not. The selected functions of the push button can only be transferred to the device if the port status "**Connected**" is shown.

Activity log

The Activity Log area is displayed in the lower section of the application window and shows the current error and status messages of the application.

Apply settings

To save the changes permanently in the device, please press "**Apply settings**"!

As soon as settings are saved or activated, you will receive a message in the *Activity log*.

Use of the configuration storage (memory slots)

Function settings can be saved in up to 10 **memory slots** of the microcontroller. These memory locations can also be changed during operation (e.g. via a specific button). **The configurations of the memory slots are retained when the microcontroller is disconnected from the USB cable / power supply.** As soon as the FABI device is supplied with power again via the USB cable, the first slot is automatically loaded and activated.

A new storage space is created by clicking on "**New Slot**". Any name can be assigned with a subsequent click in the text field. If you click on the arrow on the right-hand side of the text field, a drop-down menu opens that shows slots that have already been saved and where they can be selected. By clicking on "**Previous Slot**" or "**Next Slot**" you can switch „step by step“ between the existing memory locations. Click "**Delete slot**" to delete the current slot.



Figure 3: Creating, changing and deleting storage locations ("slots")

Please note: Changes are always made in the currently displayed memory location (configuration slot). However, changes are only transferred to the device as soon as "Apply Settings" is pressed!

Loading, saving and transferring configurations

The File menu allows the entire configuration to be saved as a file (.set) on the computer. This settings file can then be transferred to the same or to a different FABl device. This means that several setups (e.g. for different users or use cases) can be saved on one computer and activated with one click. A data selection window enables the selection of a desired file name for saving (**Save Settings**) or loading (**Load Settings**) configuration settings.

Attention: When transferring the settings from a saved file to the FABl device, the current configuration settings are overwritten.

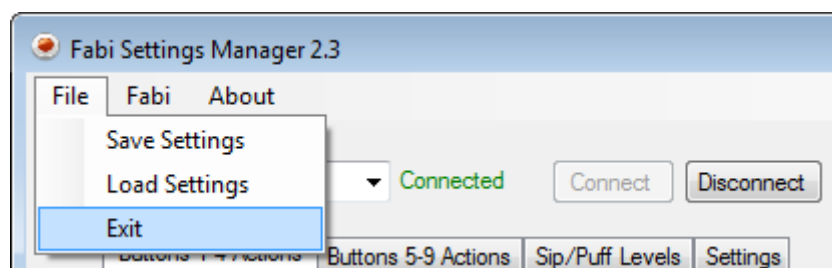


Figure 4: Loading and saving configuration settings

Assignment of the button functions

With the FabiGUI applications, up to 9 buttons can be assigned different functions. Such functions include various mouse clicks, mouse movements, scrolling or pressing keyboard keys.

Please note that with the 3D-printed FABI housing only 8 of the 9 possible buttons also have recesses for the connections (jack sockets). Usually, fewer buttons are used anyway. If more than 8 buttons are required, several FABI modules can be operated in parallel.

The following chapter explains the selection of the functions for the buttons.

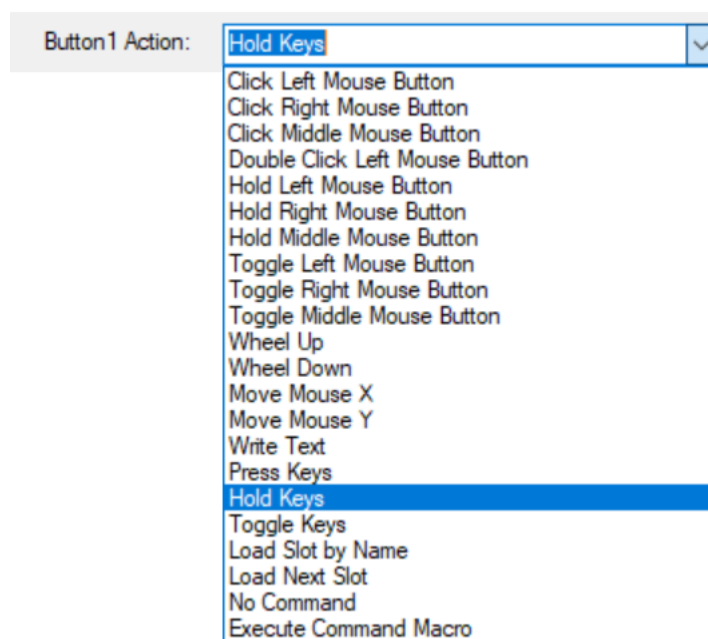


Figure 5: Selection of possible functions for buttons

Click Left / Right / Middle Mouse Button

These functions can be used to issue left, right or middle mouse clicks by pressing the button.

Note: a click consists of pressing & releasing the corresponding mouse button, both happen in quick succession after pressing the user-operated switch!

Double click left mouse button

A double click of the left mouse button is necessary, for example, to open a file. However, performing quick mouse clicks can be difficult for some users. By assigning the “Double Click Left Mouse Button” function, a double click can be carried out by simply pressing the button.

Hold Left / Right / Middle Mouse Button

With these functions, the left, right or middle mouse button remains pressed as long as the button is held down (for example, to move a file, it is necessary to keep the left mouse button pressed).

Toggle Left / Right / Middle Mouse Button

With these functions, the left, right or middle mouse button state is changed when the button is pressed. Note that the mouse button stays pressed until the button is pressed another time!

Wheel Up / down - Scroll up / down

The functions “wheel up” and “wheel down” generate activities with the scroll wheel of the computer mouse. Triggering the “Wheel Up” function results in scrolling upwards, with the “Wheel down” function scrolling downwards (useful for reading documents or websites, for example).

Mouse Move X / Y - mouse movement in X or Y direction

The "Move Mouse X" and "Move Mouse Y" functions generate computer mouse movements along the selected axes. Speed parameters can be set for these functions. When the button is pressed, the mouse pointer is accelerated up to this maximum speed.

A positive value for the X direction moves the mouse pointer to the right.

A negative value for the X direction moves the mouse pointer to the left.

A positive value for the Y direction moves the mouse pointer down.

A negative value for the Y direction moves the mouse pointer up.

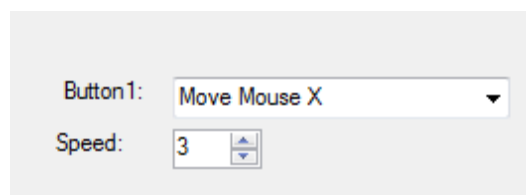


Figure 6: Screenshot of the "Mouse X" function or speed setting

Write text

The "Write Text" function allows to write a certain text every time the buttons is pressed. If you select Write Text, a blank text box will appear under the drop-down menu, then click the text box and enter the desired text:

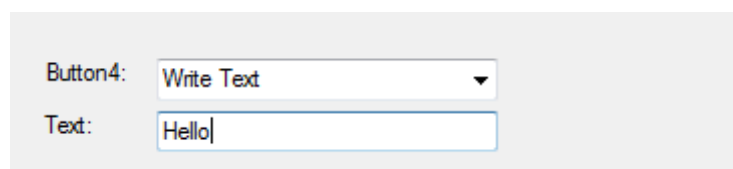


Figure 7: Screenshot of the "Write Text" function

Press Keys - press keyboard keys

The "Press Keys" function enables desired keys on the computer keyboard to be pressed as soon as the button is pressed. The keyboard keys are pressed and immediately released (the key does not stay pressed as long as the button is pressed!). The desired key can be selected from a selection box that is displayed on the left:

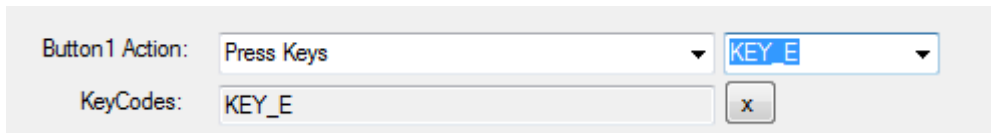


Figure 8: Screenshot of the "Press Key" function

The example in Figure 8 shows the use of the keyboard key "KEY_E" - a small "e" is written every time the key is pressed. It is also possible to select several keys for key combinations, which are then pressed / held at the same time. Keys that have already been assigned can be removed by clicking "X".

Note: Capital letters can be created in combination with "KEY_SHIFT". All other supported keyboard shortcuts can be found in the appendix.

Hold Keys - hold keyboard keys

The "Hold Keys" function enables desired keys on the computer keyboard to be held down as soon as the button is pressed. The keyboard keys are pressed as long as the button is held. Key selection works as described for the "Press Keys" command.

Toggle Keys – change state of keyboard keys

The "Toggle Keys" function enables desired keys on the computer keyboard to change their state as soon as the button is pressed. Note that the keyboard key remains pressed until the button is pressed another time! Key selection works as described for the "Press Keys" command.

Load Slot by Name - switch to configuration with a specific name

As soon as the button is pressed, the configuration with the specified name is activated. (This action is only relevant if you have saved configurations in several memory locations.)

Load Next Slot - switch to the next configuration

As soon as the button is pressed, the next configuration (the next memory location) is activated. After the last configuration, the first configuration is automatically activated. (This action is only relevant if you have saved configurations in several memory locations.)

No Command - no action

If "No Command" is selected in the function menu, no action will be taken when the button is pressed.

Execute Command Macro - execute macro commands

This action enables several commands to be executed using appropriate command abbreviations, which are entered in the text field separated by semicolons.

Example: The macro command MX 10; WA 500; KP KEY_A; moves the mouse cursor 10 points to the right, then waits 500 milliseconds and then presses the keyboard key "A".

Note: A list of the possible command and keyboard shortcuts can be found in the appendix.

Use of a pressure sensor (sip / puff)

The FABI device enables the use of an optional pressure sensor (sip / puff or suction-blow sensor). Analog pressure sensors such as the sensor type [MPXV7007GP](#) can be used. The analog voltage is connected to the solder contact A0 on the microcontroller board. The sensor must also be supplied with operating voltage (correctly connect 5V and GND).

Then, in the tab "Sip / Puff Levels", corresponding threshold values for the strength of the sip or puff activity can be set. These activities can trigger additional functions. The rest value of the sensor (when neither sipping or puffing) is in the middle of the value range, at approx. 512.

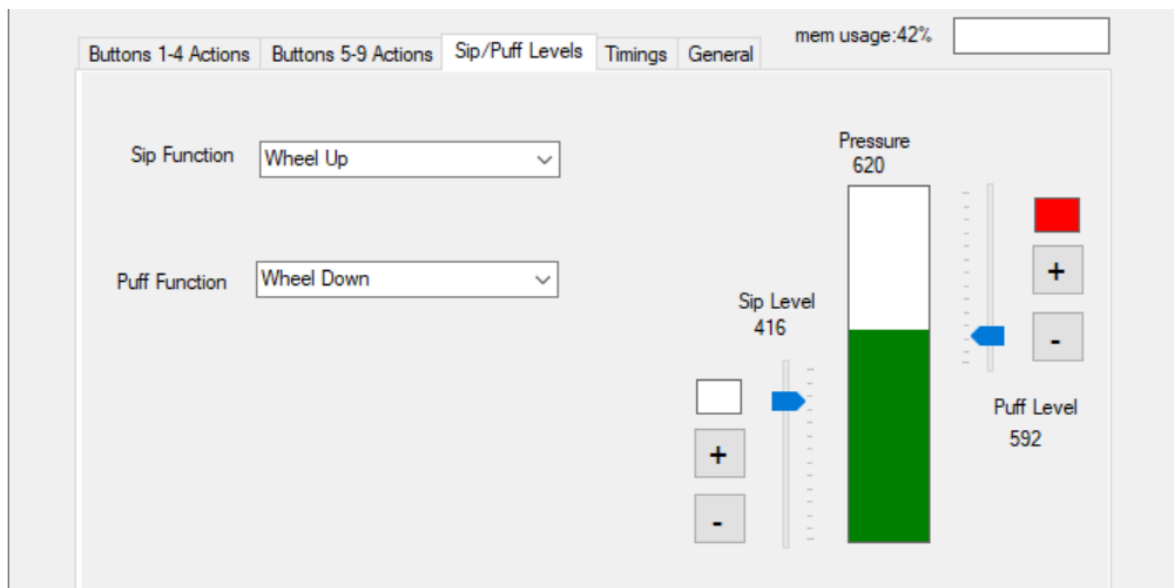


Figure 9: Screenshot of the settings for Sip and Puff

Options in the Timings Tab

Via the “Settings” tab, additional parameters for the operation of the FABI system can be set, including the use of “**Long Press**” functions when the button is pressed for a particularly long time, and the setting of **anti-tremor** filters for minimal periods of time when pressing buttons to avoid accidental activation - see Figure 10.

Note: The options in the setting tab are also defined per slot – this means they could differ in different slots!

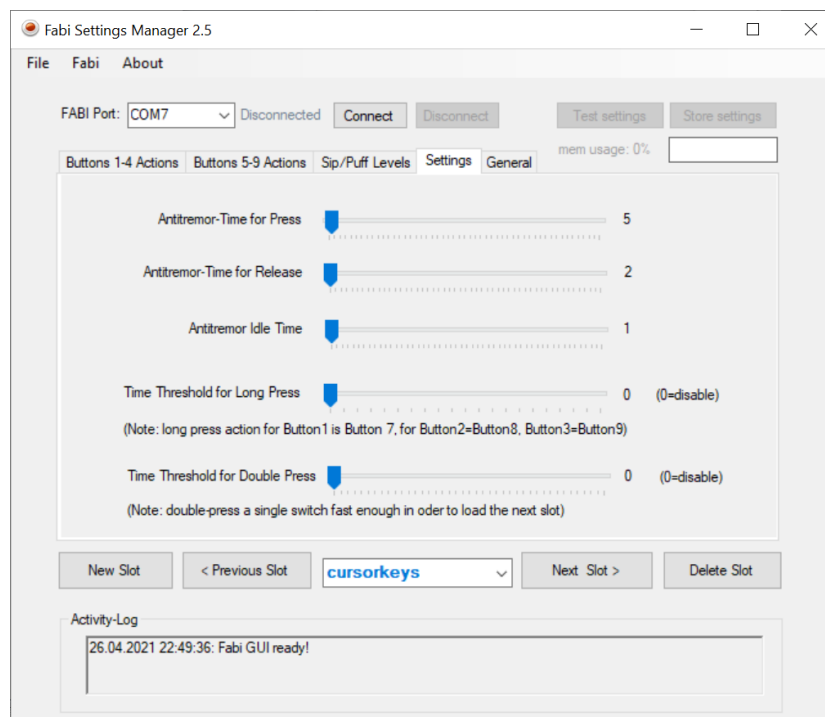


Figure 10: Screenshot of the settings menu

Use of the "Anti-tremor" functions

The **anti-tremor** parameters can be used to define different time spans that are checked by the FABI system when a button is triggered. In this way, the involuntary triggering of buttons in the event of tremors or problems with fine motor skills can be minimized:

- "Antitremor Time for Press" defines the minimum time span that a button must be pressed for the action to be carried out.
- "Antitremor Time for Release" defines the minimum period of time that a button must be released so that the release is recognized.
- "Antitremor Idle Time" defines the minimum period of time that must elapse between successive presses of a button.

Use of the "Long Press" functions

The value "**Time Threshold for Long Press**" defines the minimum duration of a "long button press" in milliseconds. Consequently, an alternative action can be carried out when performing a long-press. This is particularly useful when a person can only use a small number of buttons. An alternative function or switching of the whole configuration can then be carried out via a long-press. The Longpress function is disabled if a time span of 0 milliseconds is set.

Currently, only buttons that are attached to ports 1, 2 or 3 support the long press function. However, since keys 1,2 and 3 are already assigned to functions for normal (short) operation, the desired functions for the "longpress" activity must be entered for other buttons that are not otherwise in use in the application:

Please note:

If Button1 is pressed long, the function for Button7 is executed. If Button2 is pressed long, the function for Button8 is executed. If Button3 is pressed long, the function for Button9 is executed.

Use of the "Double Press" function

The value "**Time Threshold for Double Press**" defines the maximum duration of a "double button press" in milliseconds. If a double press is detected, **an automatic slot change to the next slot** is performed. This is particularly useful when a person can only use a single button: using two fast button presses, the function of the button can be changed. Thus, multiple keyboard keys could be pressed alternatively (e.g. for game control) or the mouse cursor could be moved in different directions using a single switch.

Options in the General Tab

Via the “General” tab, the Bluetooth settings and the Automatic Dwelling can be adjusted.

Note: The options in the General tab are defined per slot – this means they could differ in different slots!

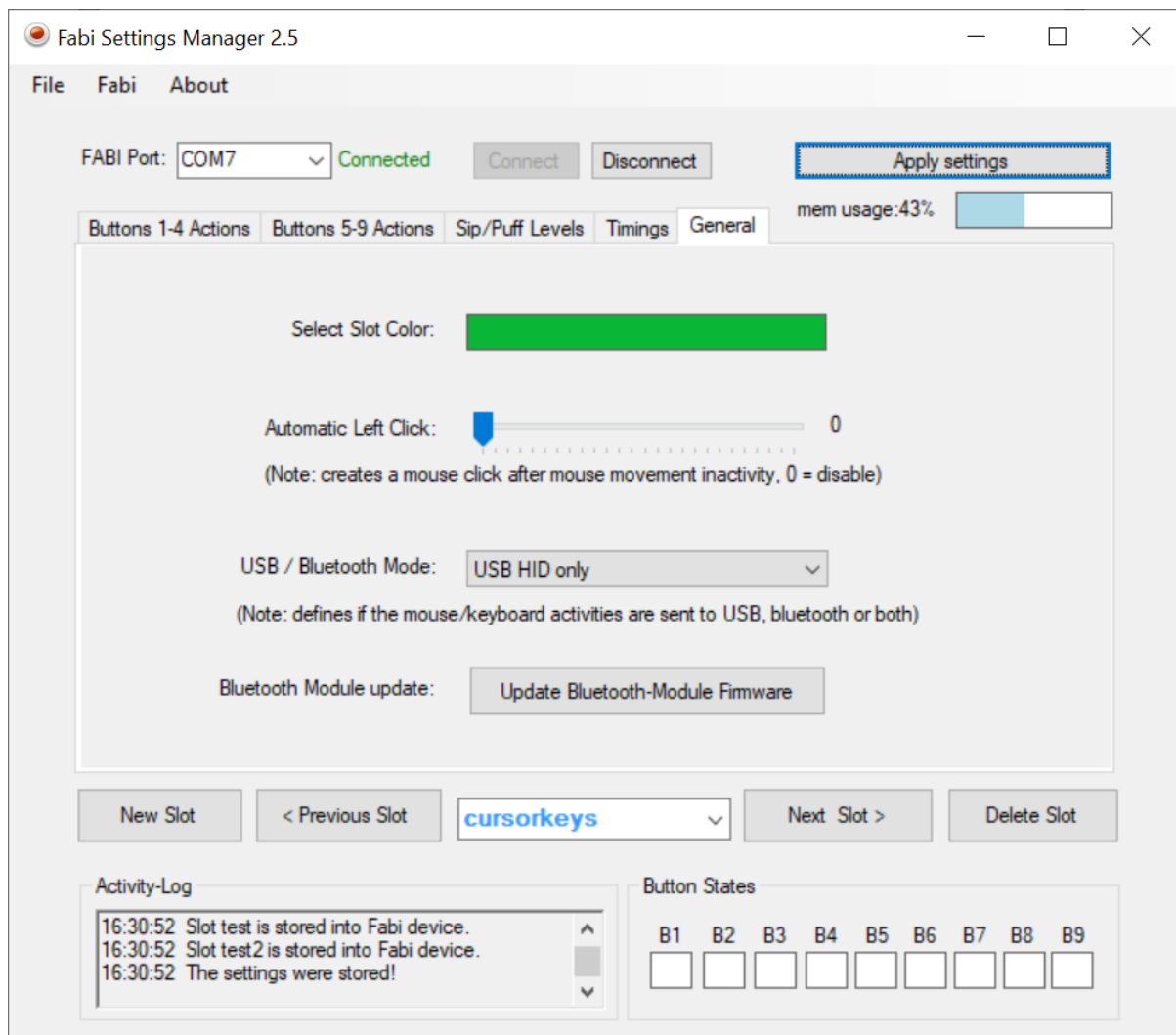


Figure 11: Screenshot of the General tab

Select Slot Color - Selecting a color for the configuration.

By clicking on the color field, a color selection dialog appears on the screen. A desired color can be selected here. The color LED in the FABI housing will emit this color as soon as the current configuration is activated. In this way, characteristic colors can be assigned to all configuration slots. **Note:** This function is only available in the PCB version of the FABI system.

Auto-Dwell Time setting

The automatic dwell setting allows the creation of a left mouse click after mouse movement occurred. The selected time period must pass (without mouse movements), then the mouse click is created. This allows complete control of a mouse cursor with a low number of switches or

(combined with the automatic slot change function) with a single switch. A value of 0 disables the automatic dwell function.

Controlling Bluetooth mode

This combobox selection defines if mouse- and keyboard commands are created via USB, Bluetooth or both:

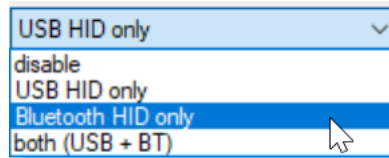


Figure 12: Bluetooth mode and selection of BT/USB

Note: The USB/Bluetooth mode selection is only relevant if the optional Bluetooth AddOn-Module has been connected to the FABI device (see Usage of the Bluetooth Module).

This setting is defined per slot – so it can change for different slots. Thus, the same FABI device can be used to control e.g. a Laptop via USB and a Smartphone / Tablet via Bluetooth.

Bluetooth Module update

Pressing this button will attempt to download the latest software (firmware) for the Bluetooth module and install it on the module. This process can take a few minutes and is only possible if a Bluetooth module is connected to the FABI system.

Demo Settings

The FABI download package includes the directory "Settings" - here you will find various suggestions for FABI configuration settings, for example a 1-button mouse or a combination of mouse and cursor key controls.

Have fun trying out and creating your own FABI configurations!

Using the Bluetooth module

The FABI system allows the use of an optional Bluetooth "AddOn" module for wireless device connections to cell phones, tablets and computers with Bluetooth capability. The Bluetooth module is available separately from the AsTeRICS Foundation or included in the appropriate version of the FABI kit.

Installation of the Bluetooth module

The Bluetooth module is very easy to use with the board version of the FABI system (kit). (Using it with a single microcontroller is also possible and is described in more detail in the advanced information in the Github repository of the Bluetooth module, see https://github.com/asterics/esp32_mouse_keyboard).

The Bluetooth module is plugged onto the 10-pin connector in the orientation shown on the board. To do this, open the FABI housing and push the module onto the pin header provided as far as it will go (see Figure 13):



Figure 13: Bluetooth module, connected to FABI PCB

Connecting with a Bluetooth device (pairing)

The Bluetooth module indicates by fast flashing (approx. 2 times per second) that it is ready to establish a connection with a host device. The host device could be a cell phone, for example. A "New Bluetooth" device must now be added in the Bluetooth settings of the host device. Here it should be possible to select the "FABI" device name. If the connection is successful, the LED of the Bluetooth module should flash slowly (approx. 1 time per second). The target device can now be controlled via the FABI system in parallel to the device which is already connected via USB. The decision whether an action is performed via USB or via Bluetooth is made in the settings in the "General" tab (see Figure 12).

List of supported macro commands

Abbreviation	function	example
CL	click left mouse button	
CR	click right mouse button	
CM	click middle mouse button	
CD	click double with left mouse button	
HL	hold the left mouse button	
HR	hold the right mouse button	
HM	hold the middle mouse button	
TL	toggle the left mouse button	toggle: changes pressed <-> not pressed
TM	toggle the middle mouse button	
TR	toggle the right mouse button	
RL	release the left mouse button	
RR	release the right mouse button	
RM	release the middle mouse button	
WU	move mouse wheel up	
WD	move mouse wheel down	
MX <int>	move mouse in x direction	MX 4 moves cursor 4 pixels to the right
MY <int>	move mouse in y direction	MY -10 moves cursor 10 pixels up
KW <string>	keyboard write string	KW Hello! writes "Hello!" on the keyboard
KP <string>	key press: Press keyboard keys (and immediately release them). Keys are identified by keyboard shortcuts (see list below)	KP KEY_UP presses the "Cursor-Up" key KP KEY_CTRL KEY_ALT KEY_DELETE presses all 3 keys
KH <string>	key hold: Press and hold keyboard keys	see KP
KT <string>	key toggle: change state of keyboard keys (press if not pressed, release if pressed)	see KP
KR <string>	key release Keys are identified by keyboard shortcuts (see list below)	KR KEY_UP releases the "Cursor-Up" key
RA	release all Release all currently pressed keys and mouse button	
WA <int>	wait wait a certain number of milliseconds	WA 100 waits 100 milliseconds
NE	next slot: switch to next slot	
LO <string>	load slot changes to given slot	LO mouse

List of abbreviations for keyboard keys

Letters
KEY_A KEY_B KEY_C KEY_D KEY_E KEY_F KEY_G KEY_H KEY_I KEY_J KEY_K KEY_L KEY_M KEY_N KEY_O KEY_P KEY_Q KEY_R KEY_S KEY_T KEY_U KEY_V KEY_W KEY_X
Digits
KEY_1 KEY_2 KEY_3 KEY_4 KEY_5 KEY_6 KEY_7 KEY_8 KEY_9 KEY_0
Function keys
KEY_F1 KEY_F2 KEY_F3 KEY_F4 KEY_F5 KEY_F6 KEY_F7 KEY_F8 KEY_F9 KEY_F10 KEY_F11 KEY_F12 KEY_F13 KEY_F14 KEY_F15 KEY_F16 KEY_F17 KEY_F18 KEY_F19 KEY_F20 KEY_F21 KEY_F22 KEY_F23 KEY_F24
Navigation buttons
KEY_UP KEY_DOWN KEY_LEFT KEY_RIGHT KEY_TAB KEY_PAGE_UP KEY_PAGE_DOWN KEY_HOME KEY_END
Special buttons
KEY_ENTER KEY_SPACE KEY_BACKSPACE KEY_DELETE KEY_INSERT KEY_ESC KEY_NUM_LOCK KEY_SCROLL_LOCK KEY_CAPS_LOCK KEY_PAUSE
Alternate function buttons
KEY_SHIFT KEY_CTRL KEY_ALT KEY_RIGHT_ALT KEY_GUI KEY_RIGHT_GUI

Further links and software recommendations

The FABI Button Interface is suitable as an alternative input system for a wide variety of purposes - from computer / smartphone control to the use of games and learning software. Depending on the number of buttons that can be used, standard programs which rely on mouse / keyboard interaction can be operated without further adjustment.

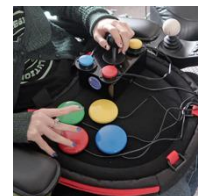
If the motor skills or the number of usable button functions are very limited, specially adapted applications also offer options for use with just one button. Here are some interesting resources:

AsTeRICS and AsTeRICS Grid

The further open source developments of the AsTeRICS Foundation allow a versatile use of button interfaces. The [AsTeRICS system](#) is a construction kit for assistive technologies with which 1-button strategies for computer control can be created. [AsTeRICS Grid](#) is a flexible system for Augmentative and Alternative Communication (AAC), which can be operated via a single switch.

SpecialEffect.org

The non-profit organization SpecialEffect (<https://www.specialeffect.org.uk>) is dedicated to promoting accessible games in the UK and making specific adaptations for people with disabilities.



BLTT.org

The Better Living Through Technology website (<https://bltt.org/introduction-to->) provides useful information for key-based computer use and links to many



OneSwitch.org

Under the address <https://www.oneswitch.org.uk> Barrie Ellis has collected a wealth of tips and information for single switch gaming and special adaptations for key control of computer games. The games library, the One-Switch-Pulse System and the use of game consoles with controller adapters such as the "Titan-Two" are particularly interesting.



Contact information

AsTeRICS Foundation

Webpage: <https://www.asterics-foundation.org>

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Disclaimer of liability

The University of Applied Sciences Technikum Wien and the AsTeRICS Foundation assume no guarantee or liability for the functionality of the hardware / software modules or the correctness of the documentation.

Furthermore, the UAS Technikum Wien and the AsTeRICS Foundation are not liable for any damage to health caused by the use of the hardware / software modules provided.

The modules and information provided are used at your own risk!

Acknowledgement

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