FAIO MULTIPLEXER USB

USER MANUAL

What if you could have a switch interface that could that would let you perform many actions using only 4 switches?

Version 1.1

https://github.com/milador/FAIO_Multiplexer

Contents

Usage

The FAIO Multiplexer USB can used in different configurations based on the needs of the end user. The FAIO Multiplexer hardware can be used along different software as input device for multiple devices. The hardware allows you connect up to four input 3.5mm adaptive switches which are marked A,B,C,D on both circuit board and the enclosure.

All four switches can be used as inputs when short pressed and switch D can be used to change the operation mode when it's pressed and hold for more than 2 seconds. Table 1 represents all the possible actions for switches and their corresponding led feedback.

Button	Action	Color
A	Short press	Blue
B	Short press	Red
C	Short press	Green
D	Short press	Yellow
D	Long Press	Mode Led Color

Table 1: FAIO Multiplexer USB switch actions and feedback

The device will blink two times in the color of operating mode when the initialization process is completed and will stay in that color. The led will blink momentary in color of the switch pressed as represented in Table 1 and the led color will go back to the color of operating mode. The mode can only change when switch D is pressed and hold for 2 seconds.

The USB version is great for usage along computer or smartphone devices as it's able to simulate a USB mouse or USB keyboard device. The USB version can operate in different modes as it's represented in Table 2.

Mode Number	Mode	Color
1	Keyboard Switch	Teal
2	Morse Keyboard	Purple
3	Morse Mouse	Pink
4	Settings	Orange

Table 2: FAIO Multiplexer USB modes

Keyboard Switch mode

The Keyboard Switch will operate similar to a four key keyboard which is great for using as switches for your computer or smartphone device through features such as Switch access and it can also be used to play computer games via WASD format keyboard.

Button	Action	Color	Result
A	Short press	Blue	Send 'a' keystroke
B	Short press	Red	Send 'b' keystroke
C	Short press	Green	Send 'c' keystroke
D	Short press	Yellow	Send 'd' keystroke
D	Long Press	Mode Led Color	Change operating mode

Table 3: FAIO Multiplexer USB switch actions

The time between each switch press actions is calculated by switch reaction levels which can be changed in settings mode or manually through the software. The switch reaction time variable is used to calculate the reaction time for each of the 10 levels as represented in Table 4.

SWITCH_REACTION_TIME 50

The switch reaction time variable is set to 50 by default.

Level	10	9	8	7	6	5	4	3	2	1
Time (ms)	1*50	2*50	3*50	4*50	5*50	6*50	7*50	8*50	9*50	10*50

Table 4: FAIO Multiplexer USB switch reaction time

Morse Keyboard Mode

This mode is used to convert morse code to keystrokes via 2 switches. The first switch acts as dot and second switch acts as dash as explained in Table 5.

Button	Action	Color	Result
A	Short press	Blue	Send '.' To morse stack
B	Short press	Red	Send '-' To morse stack
D	Long Press	Mode Led Color	Change operating mode

Table 5: FAIO Multiplexer USB morse keyboard mode

The conversion of morse code combination to characters is done in software based on the static variables in the beginning of the code. These values can be customized based on your needs.

MORSE_TIMEOUT 1000

MORSE_REACTION_TIME 10

The timeout is the time in ms that is measured since last switch action to perform the morse conversation and send the result as keystroke. The time by default is set to 1 second (1000 ms) which means the device will convert the morse code combinations if switch A and B (Dot , Dash) are not pressed for 1 second.

The reaction time is the multiplier for time between each dot and dash. The higher reaction level means lower reaction time. The reaction levels can be changed using switches in the settings mode but it's also possible to change the morse reaction time multiplier in the code. Table 6 can be used to understand the morse reaction time calculation.

Level	10	9	8	7	6	5	4	3	2	1
Time (ms)	(1.5^1)*10	(1.5^2)*10	(1.5^3)*10	(1.5^4)*10	(1.5^5)*10	(1.5^6)*10	(1.5^7)*10	(1.5^8)*10	(1.5^9)*10	(1.5^10)*10

Table 6: FAIO Multiplexer USB morse reaction time

The table of morse code combinations can be found on EasyMorse project github repository.

Morse Mouse Mode

This mode is used to convert morse code to mouse via 2 switches. The first switch acts as dot and second switch acts as dash as explained in Table 7.

Button	Action	Color	Result
A	Short press	Blue	Send '.' To morse stack
B	Short press	Red	Send '-' To morse stack
D	Long Press	Mode Led Color	Change operating mode

Table 7: FAIO Multiplexer USB morse mouse mode

This mode users the morse timeout value and morse reaction time to convert morse code combinations to mouse actions similar to morse keyboard mode. The table of morse code combinations can be found on EasyMorse project github repository. The conversion table is represented in Table 8 in addition.

Morse code	Result
-	Move Up
--	Move Down
..	Move Left
...	Move Right
.-	Left Click
.--	Right Click
..-	Double Left Click
..--	Double Right Click
-.	Left Click & Hold/Release
-..	Right Click & Hold/Release

Table 8: FAIO Multiplexer USB morse mouse code conversion table

The mouse move actions are fixed in terms of number of pixels that cursor can be moved for each morse code combination , but there is mouse move multiplier variable available in the software that allows you to customize the mouse move behavior based on your needs.

MOUSE_MOVE_MULTI 2

The mouse move multiplier variable is set to 2 by default.

Settings Mode

The settings mode is used to change the reaction level and reaction time using the A and B switches. The led will blink in blue when react level is increased and in red when reaction level is decreased. The number of led blinks indicate new reaction level. The led will blink 10 times when it reaches maximum or minimum reaction levels.

Button	Action	Color	Result
A	Short press	Blue	Increase Reaction level (Decrease Reaction time)
B	Short press	Red	Decrease Reaction level (Increase Reaction time)
D	Long Press	Mode Led Color	Change operating mode

Table 9: FAIO Multiplexer USB settings mode

There are total of 10 levels and the switch reaction times and morse reaction times can be calculated using Tablets 10 and 11.

Level	10	9	8	7	6	5	4	3	2	1
Time (ms)	1*50	2*50	3*50	4*50	5*50	6*50	7*50	8*50	9*50	10*50

Table 10: FAIO Multiplexer USB switch reaction time

Level	10	9	8	7	6	5	4	3	2	1
Time (ms)	(1.5^1)*10	(1.5^2)*10	(1.5^3)*10	(1.5^4)*10	(1.5^5)*10	(1.5^6)*10	(1.5^7)*10	(1.5^8)*10	(1.5^9)*10	(1.5^10)*10

Table 11: FAIO Multiplexer USB morse reaction time

Customization

The FAIO Multiplexer USB can easily be customized by changing the value of variables at the beginning of FAIO Multiplexer USB software. The following variables can be changed for customization purposes:

```
#define MORSE_TIMEOUT 1000
```

The time of no activity which is used as flag to convert the morse combination to keystroke

```
#define MORSE_REACTION_TIME 10
```

The morse reaction time multiplier between each dot and dash actions

```
#define MOUSE_MOVE_MULTI 2
```

The morse mouse move multiplier variable

```
#define SWITCH_REACTION_TIME 50
```

The switch reaction time multiplier between each switch action

```
#define SWITCH_MODE_CHANGE_TIME 2000
```

The time that switch D needs to be hold in ms to perform mode change action

```
#define LED_BRIGHTNESS 150
```

The brightness of led for mode indication

```
#define LED_ACTION_BRIGHTNESS 150
```

The brightness of led for action indication

```
//Switch properties

const switchStruct switchProperty[] {

  {1,"DOT",'a',5,1},                    //{1=dot,"DOT",'a',5=blue,1=1xMORSE_REACTION}

  {2,"DASH",'b',6,3},                   //{2=dash,"DASH",'b',6=red,3=3xMORSE_REACTION}

  {3,"",'c',1,1},                       //{3,"",'c',1=green,1=1xMORSE_REACTION}
  {4,"",'d',3,1}                        //{4,"",'d',3=yellow,1=1xMORSE_REACTION}

};
```

The values of third column can be changed to different characters and the fourth column can be changed for customization of led feedback.

```
//Settings Action properties

const settingsActionStruct settingsProperty[] {

  {1,"Increase Reaction",5},                    //{1=Increase Reaction,5=blue}

  {2,"Decrease Reaction",6},                    //{2=Decrease Reaction,6=red}

  {3,"Max Reaction",1},                         //{3=Max Reaction,1=green}

  {4,"Min Reaction",1}                          //{4=Min Reaction,1=green}

};
```

The third column can be changed for customization of led feedback.

```
//Mode properties

const modeStruct modeProperty[] {

  {1,"Keyboard Switch",8},

  {2,"Morse Keyboard",7},

  {3,"Morse Mouse",2},

  {4,"Settings",4}

};
```

The third column can be changed for customization of led feedback.

```
const colorStruct colorProperty[] {

  {1,"Green",{0,50,0}},

  {2,"Pink",{50,00,20}},

  {3,"Yellow",{50,50,0}},

  {4,"Orange",{50,20,0}},

  {5,"Blue",{0,0,50}},

  {6,"Red",{50,0,0}},
  {7,"Purple",{50,0,50}},
  {8,"Teal",{0,128,128}}
};
```