

Emulstick 仿真键鼠 蓝牙数据格式

with 2.4-GHz Bluetooth low energy Systems (Bluetooth LE)
Bluetooth v4.0 Compliant

仿真设备：emulstick 原生组合键鼠 (USB vid:0x0451 pid:0xe010; Dongle Firmware 1.2.1)

一, 蓝牙服务

1. 设备信息服务 GATT SERVICE UUID: 0000180A-0000-1000-8000-00805f9b34fb (通用)
通用属性, 可读取设备信息。

CLIENT CHARACTERISTIC UUID	内容	类型	Write	Read	Notify
00002A23-0000-1000-8000-00805f9b34fb	System ID	8 Bytes	No	Yes	No
00002A24-0000-1000-8000-00805f9b34fb	Model Number	String	No	Yes	No
00002A25-0000-1000-8000-00805f9b34fb	Serial Number	String	No	Yes	No
00002A26-0000-1000-8000-00805f9b34fb	Firmware Revision	String	No	Yes	No
00002A27-0000-1000-8000-00805f9b34fb	Hardware Revision	String	No	Yes	No
00002A28-0000-1000-8000-00805f9b34fb	Software Revision	String	No	Yes	No
00002A29-0000-1000-8000-00805f9b34fb	Manufacturer Name	String	No	Yes	No
00002A50-0000-1000-8000-00805f9b34fb	Product ID	7 Bytes	No	Yes	No

上述数据中, 2A23 和 2A26 项有实际效用。

2. 自定义服务 GATT SERVICE UUID: 0000F800-0000-1000-8000-00805f9b34fb
5 个属性, 作为 5 个数据传输通道

CLIENT CHARACTERISTIC UUID	仿真子设备	Write	Read	Notify
0000F801-0000-1000-8000-00805f9b34fb	Keyboard 键盘	Yes without response	Yes	Yes
0000F802-0000-1000-8000-00805f9b34fb	Gamepad 游戏手柄	Yes without response	No	Ignore
0000F803-0000-1000-8000-00805f9b34fb	Mouse 鼠标	Yes without response	No	Ignore
0000F804-0000-1000-8000-00805f9b34fb	Pen & Consumer 手写笔及控制键	Yes without response	No	Ignore
0000F80F-0000-1000-8000-00805f9b34fb	Private Control 设备控制	Yes without response	No	Yes

二, CHARACTERISTIC UUID: F801

Write: HID Keyboard User Report (符合通用格式规范)

Data length: 8Bytes

Byte0:控制键 (1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
RightGui	RightAlt	RightShift	RightCtrl	LeftGui	LeftAlt	LeftShift	LeftCtrl

Byte1: 固定为 0x00

Byte2~Byte7: keyboard button usage id (Min:4,Max:106), 无效时为 0

注: Keyboard Usage ID Table 见附录

Read or Notify: HID Keyboard Led Report (符合通用格式规范)

Data length: 1Byte

Byte0:Led 指示灯(1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	Kana	Compose	Scrolllock	Capslock	Numlock

三, CHARACTERISTIC UUID: F802

Write: HID Gamepad User Report (符合通用格式规范)

Data length: 9Bytes

Byte0: 固定为 0x21

Byte1: Stick1(X)水平位置绝对值, 有效值范围 -127~+127

Byte2: Stick1(Y)垂直位置绝对值, 有效值范围 -127~+127

Byte3: Stick2(Z)水平位置绝对值, 有效值范围 -127~+127

Byte4: Stick2(Rz)垂直位置绝对值, 有效值范围 -127~+127

Byte5: Slider1(Rx)位置绝对值, 有效值范围 -127~+127

Byte6: Slider2(Ry)位置绝对值, 有效值范围 -127~+127

Byte7: Pov 方向键 4 位, 有效值 1~8, 向上方向开始顺时针 8 向, 无效为 0

4 Buttons (1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Button 4	Button 3	Button 2	Button 1	Pov 4bits			

Byte8: 8 Buttons

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Button 12	Button 11	Button 10	Button 9	Button 8	Button 7	Button 6	Button 5

Notify: Ignore

四, CHARACTERISTIC UUID: F803

Write: HID Mouse User Report (符合通用格式规范)

Data length: 6Bytes

Byte0: 5 鼠标键(1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	Button5 (辅助)	Button4 (辅助)	Button3 (中键)	Button2 (右键)	Button1 (左键)

Byte1: 鼠标指针移动 X 轴相对值, 低 8bits

Byte2: 鼠标指针移动 X 轴相对值, 高 8bits

上述 2 字节组成的 16bits 值, 有效值范围 -2047~+2047。

Byte3: 鼠标指针移动 Y 轴相对值, 低 8bits

Byte4: 鼠标指针移动 Y 轴相对值, 高 8bits

上述 2 字节组成的 16bits 值, 有效值范围 -2047~+2047。

Byte5: 鼠标指针移动 Z 轴(滚轮)相对值, 有效值范围 -127~+127。

Notify: Ignore

五, CHARACTERISTIC UUID: F804

Write: 1. HID Pen User Report

Data length: 6Bytes

Byte0: 固定为 0x41

Byte1: 3 功能键(1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0	0	0	0	0	Barrel	Tip Switch	In Range

Byte2: X 轴绝对值, 低 8bits

Byte3: X 轴绝对值, 高 8bits

上述 2 字节组成的 16bits 值, 有效值范围 0~3840, 对应屏幕水平分辨率。

Byte4: Y 轴绝对值, 低 8bits

Byte5: Y 轴绝对值, 高 8bits

上述 2 字节组成的 16bits 值, 有效值范围 0~2160, 对应屏幕垂直分辨率。

Write: 2. HID Consumer User Report

Data length: 4Bytes

Byte0: 固定为 0x42

Byte1: 数字键组 4 位, 键值有效值范围 1~10, 无效为 0

4 功能键(1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Volume	Volume	Channel	Channel	Number			
-	+	-	+	4bits			

Byte2: 功能键组, 键值有效值范围 1~47

1	Assign	17	sleep	33	Copy
2	Play	18	Illumination	34	Cut
3	Pause	19	Menu	35	Paste
4	Record	20	MenuPick	36	Select All
5	Fast Forward	21	Brightness+	37	Find
6	Fast Rewind	22	Brightness-	38	Search
7	Scan Next	23	Mail	39	Goto
8	Scan Prev	24	Address Book	40	Home
9	Stop	25	Calculator	41	Back
10	Eject	26	Machine Browser	42	Forward
11	Repeat	27	Internet Browser	43	Stop
12	Stop/Eject	28	Telephony/Dialer	44	Refresh
13	Play/Pause	29	Terminal Lock	45	Bookmarks

14	Mute	30	Desktop	46	Show Windows
15	Power	31	Clock	47	Show Apps
16	Reset	32	Undo		

Byte3: 8 功能键(1 有效, 0 无效)

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
Dpad Left	Dpad Right	Dpad Down	Dpad Up	Speaker Mute	System Wake up	System Sleep	Power Down

Notify: Ignore

六, CHARACTERISTIC UUID: F80F

Write: 私有数据传输指令, 暂未开放, 请勿使用

Data length: <20Bytes

Notify: 私有数据传输指令, 暂未开放, 请勿使用

Data length: <20Bytes

附件一 Keyboard Usage ID Table (partial)

键名	十进制值	US/Ansi 字符或功能键
KB_a_and_A	4	"a", "A"
KB_b_and_B	5	"b", "B"
KB_c_and_C	6	"c", "C"
KB_d_and_D	7	"d", "D"
KB_e_and_E	8	"e", "E"
KB_f_and_F	9	"f", "F"
KB_g_and_G	10	"g", "G"
KB_h_and_H	11	"h", "H"
KB_i_and_I	12	"i", "I"
KB_j_and_J	13	"j", "J"
KB_k_and_K	14	"k", "K"
KB_l_and_L	15	"l", "L"
KB_m_and_M	16	"m", "M"
KB_n_and_N	17	"n", "N"
KB_o_and_O	18	"o", "O"
KB_p_and_P	19	"p", "P"
KB_q_and_Q	20	"q", "Q"
KB_r_and_R	21	"r", "R"
KB_s_and_S	22	"s", "S"
KB_t_and_T	23	"t", "T"
KB_u_and_U	24	"u", "U"
KB_v_and_V	25	"v", "V"
KB_w_and_W	26	"w", "W"
KB_x_and_X	27	"x", "X"
KB_y_and_Y	28	"y", "Y"
KB_z_and_Z	29	"z", "Z"
KB_1_and_Symbol	30	"1", "!"
KB_2_and_Symbol	31	"2", "@"
KB_3_and_Symbol	32	"3", "#"
KB_4_and_Symbol	33	"4", "\$"
KB_5_and_Symbol	34	"5", "%"
KB_6_and_Symbol	35	"6", "^"
KB_7_and_Symbol	36	"7", "&"
KB_8_and_Symbol	37	"8", "*"
KB_9_and_Symbol	38	"9", "("
KB_0_and_Symbol	39	"0", ")"
KB_Enter	40	"Enter"
KB_Escape	41	"Esc"
KB_Backspace	42	"Back Space"
KB_Tab	43	"Tab"
KB_Spacebar	44	"Space Bar"
KB_Minus	45	"_"; "-"
KB_Equal_and_Plus	46	"="; "+"
KB_Bracket_Left	47	"["; "{"
KB_Bracket_Right	48	"]"; "}"
KB_Slash	49	"\"; " "
KB_NonUs_Hashtag	50	(Non-US/Ansi)
KB_Semicolon	51	";"; "."
KB_Quotation	52	""; "\""
KB_GraveAccent	53	"`"; "~"
KB_Comma	54	","; "<"
KB_Period	55	."; ">"
KB_Division	56	"/"; "?"
KB_CapsLock	57	"Caps Lock"
KB_F1	58	"F1"
KB_F2	59	"F2"
KB_F3	60	"F3"

KB_F4	61	"F4"
KB_F5	62	"F5"
KB_F6	63	"F6"
KB_F7	64	"F7"
KB_F8	65	"F8"
KB_F9	66	"F9"
KB_F10	67	"F10"
KB_F11	68	"F11"
KB_F12	69	"F12"
KB_PrintScreen	70	"Print Sreen"
KB_ScrollLock	71	"Scroll Lock"
KB_Pause	72	"Pause"
KB_Insert	73	"Ins"
KB_Home	74	"Home"
KB_PageUp	75	"PageUp"
KB_Delete	76	"Del"
KB_End	77	"End"
KB_PageDown	78	"Page Down"
KB_RightArrow	79	"Arrow Right"
KB_LeftArrow	80	"Arrow Left"
KB_DownArrow	81	"Arrow Down"
KB_UpArrow	82	"Arrow Up"
KP_NumLock_and_Clear	83	"N/L"
KP_Division	84	"/"
KP_Multiply	85	"*"
KP_Minus	86	"-"
KP_Plus	87	"+"
KP_Enter	88	"Enter"
KP_1_and_End	89	"1", "End"
KP_2_and_DownArrow	90	"2", "Arrow Down"
KP_3_and_PageDown	91	"3", "Page Down"
KP_4_and_LeftArrow	92	"4", "Arrow Left"
KP_5	93	"5"
KP_6_and_RightArrow	94	"6", "Arrow Right"
KP_7_and_Home	95	"7", "Home"
KP_8_and_UpArrow	96	"8", "Arrow Up"
KP_9_and_PageUp	97	"9", "Page Up"
KP_0_and_Insert	98	"0", "Ins"
KP_Period_and_Delete	99	".", "Del"
KB_NonUs_Slash_Right	100	(Non-US/Ansi)
KB_PC_Application	101	"Menu"
KB_Power	102	(Not a physical key)
KP_Equal	103	"="
KB_MAC_F13	104	"F13"
KB_MAC_F14	105	"F14"
KB_MAC_F15	106	"F15"

示例一: 键盘操作报告 (UUID: F801)

1. 用户按 Win+Shift+s (Win10 截屏快捷键) 为例。

用户操作	Report data
按下右 Win 键	80H 00H 00H 00H 00H 00H 00H 00H
按下右 Shift 键	A0H 00H 00H 00H 00H 00H 00H 00H
按下 s 键	A0H 00H 16H 00H 00H 00H 00H 00H
释放 s 键	A0H 00H 00H 00H 00H 00H 00H 00H
释放 Win 键和 Shift 键	00H 00H 00H 00H 00H 00H 00H 00H

2. 用户按 Shift+上键+右键为例。

用户操作	Report data
按下左 Shift 键	02H 00H 00H 00H 00H 00H 00H 00H
按下↑键	02H 00H 52H 00H 00H 00H 00H 00H
按下→键	02H 00H 52H 4FH 00H 00H 00H 00H
释放↑键	02H 00H 4FH 00H 00H 00H 00H 00H
释放→键	02H 00H 00H 00H 00H 00H 00H 00H
释放 Shift 键	00H 00H 00H 00H 00H 00H 00H 00H

示例二: 鼠标操作报告 (UUID: F803)

用户移动鼠标并点击为例。

用户操作	Report data
指针向右下移动(6,12)	00H 06H 00H 0CH 00H 00H
指针向左下移动(-2,3)	00H FEH FFH 03H 00H 00H
按下鼠标左键	01H 00H 00H 00H 00H 00H
释放鼠标左键	00H 00H 00H 00H 00H 00H

示例三: Consumer 操作报告 (UUID: F804)

用户按媒体控制键为例。

用户操作	Report data
按下 Play 键	42H 00H 02H 00H
释放 Play 键	42H 00H 00H 00H
按下音量+键	42H 40H 00H 00H
释放音量+键	42H 00H 00H 00H
按下 Stop 键	42H 00H 09H 00H
释放 Stop 键	42H 00H 00H 00H