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BlueHID-P

Interface description

Release r06

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Note

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1 Introduction

This paper describes the basic properties and interfaces of the BlueHID-P firmware from Stollmann E+V GmbH.

This document is applicable for firmware version 1.022 and newer.

2 Description

The BlueHID-P firmware is available in 2 variants.

The BlueHID-P/DKB firmware implements the following Bluetooth profiles and roles: HID profile, role device, device type keyboard.

The BlueHID-P/DM firmware implements HID profile, role device, device type mouse.

The BlueHID-P firmware runs on a BlueMod+P2x/G2.

A keyboard or mouse device can be connected to the serial interface of the BlueMod+P2x/G2.

3 Interfaces

3.1 Bluetooth interface

Bluetooth 2.0

HID profile

role device, device type keyboard

or

role device, device type mouse

GAP profile

3.2 Serial interface

9600 bps, data format 8 data bits, no parity, one stop bit.

Logical data format according to chapter 4 Serial IF Logical.

Hardware flow control is active (UARTS_CTS output on Pin 6 of the module BlueMod+P25).

Note: Only RX data is essential for operation of the device. TX data is optional.

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3.3 GPIO interface

The following GPIO lines are used by the firmware:

GPIO	Signal	Type.	active	usage
0	NUM LOCK	O	H	NUM LOCK Led on (keyboard only)
1	CAPS LOCK	O	H	CAPS LOCK Led on (keyboard only)
2	SCROLL LOCK	O	H	SCROLL LOCK Led on (keyboard only)
3	COMPOSE	O	H	COMPOSE Indicator set (keyboard only)
4	BONDABLE_ACTIVE	O	H	A high state of this signal indicates that the device is in bondable mode and visible
5	reserved	I - PD		
6	BONDABLE_ENABLE	I - PD	H	enable bondable mode and visibility
7	reserved	I - PD		
8	reserved	I - PU		
9	STATE_LED	O	H	Device state and Error indication, see below
10	KANA	O	H	KANA Indicator set
11	reserved	I - PU		
12	reserved	I - PU		
13	/PWD_DISABLE	I - PU	L	Power down Mode forbidden
14	/READY	O	L	Device initialized OK
15	/CONNECTED	O	L	H = not connected to host L = connected to host

(I=Input, O=Output, PD=Chip internal Pull-Down and PU=Chip internal Pull-UP)

Notes:

- During active power down mode, the device internal UART is disabled. Any data sent to the UART during power down mode is lost. During active power down mode, the /UART_CTS signal is inactive.
- If the processor is in power down mode, setting /PWD_DISABLE pin low is used to wake up the processor from power down mode. Wakeup from power down mode does require a certain time to startup and stabilize local oscillators. Typical wakeup time is between 15 and 20 ms. When wakeup is completed, /UART_CTS is asserted.

3.3.1 Bondable mode after start-up of the HID device

As long as the HID device is not bonded to another device it will enter the bondable mode automatically after start-up for a time period of 180 seconds and is visible during this time period.

The bondable mode is left when:

- successful bonding is performed and BONDABLE_ENABLE signal is low
- falling edge of BONDABLE_ENABLE signal is recognized
- time period of 180 seconds is expired and BONDABLE_ENABLE signal is low

3.3.2 BONDABLE_ENABLE signal

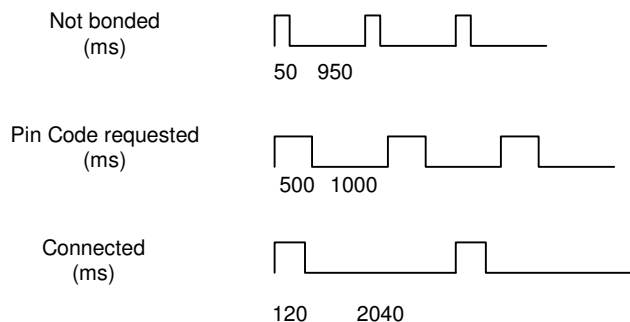
The host controls the bondable mode state of the HID device with this signal.

As long as the signal is active the device stays in bondable mode and is visible.

When initiating this state any previous connection is disconnected by an “virtual cable unplug” request.

Note: The local host has full control over the time the HID device stays in bondable mode. Please keep in mind that the device is discoverable during this time and consider Bluetooth requirements.

3.3.3 STATE_LED signal



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4 Serial IF Logical Data format

4.1 General message format

A message on the serial IF has the following format:

message header			message payload
MsgTag	ParameterLen	Checksum	0 to Parameter Len byte data

MsgTag

bit1 – bit0:

reserved must be always 0

bit 2- bit 6:

Message Type

bit 7:

extension bit must be always 0

ParameterLen

This field defines the length of the message payload as a number of bytes.

A message without parameters has a parameter length = 0.

Maximum parameter length is 255 bytes.

The 3 byte header is not considered in the parameter length.

Checksum

This field contains a checksum over MsgTag and ParameterLen.

It is calculated as MsgTag XOR ParameterLen.

4.2 Messages send to the BlueHID-P firmware

4.2.1 HID report - transparent message

Message Type = 0x01

This message is a input message on the serial Interface. It is used to transport HID reports via the Serial IF and the Bluetooth link to the HID host. The parameter field

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contains a HID report as defined in the USB specifications. The BlueHID-P firmware adds Bluetooth specific headers.

The HID report must be compliant with the HID report descriptor.

4.2.2 Version Info Request

Message Type = 0x10

This message is used to get the version info string from the BlueHID-P firmware. The firmware will send out a version info response after receiving this message.

4.2.3 Bluetooth Device Address Request

Message Type = 0x11

This message is used to read out the Bluetooth address of the module. The module will send a Bluetooth address response packet as a consequence of this command.

4.3 Messages received from the BlueHID-P firmware

4.3.1 Version Info Response

Message Type = 0x10

This is the answer to a version info request. The payload field contains a variable length version info string.

4.3.2 Bluetooth Device Address Response

Message Type = 0x11

This is the answer to a Bluetooth device address request. The payload field contains the Bluetooth address as a 12 char ASCII coded number.

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5 Report descriptors

5.1 Default descriptor for keyboard

The default report descriptor used by the BlueHID-P/DKB firmware is defined as follows:

0x05	0x01		Usage Page (Generic Desktop Control)
0x09	0x06		Usage (Keyboard)
0xA1	0x01		Collection (Application)
0x85	0x02		ReportID (1)
0x05	0x08		Usage Page (LED)
0x19	0x01		Usage Minimum (1)
0x29	0x05		Usage Maximum (5)
0x15	0x00		Logical Minimum (0)
0x25	0x01		Logical Maximum (1)
0x75	0x01		Report Size (1)
0x95	0x05		Report Count (5)
0x91	0x02		Output (Data, Variable, Absolute)
0x95	0x03		Report Count (3)
0x91	0x01		Output (Constant)
0x05	0x07		Usage Page (Keyboard/Keypad Keys)
0x19	0xE0		Usage Minimum (224)
0x29	0xE7		Usage Maximum (231)
0x95	0x08		Report Count (8)
0x81	0x02		Input (Data, Variable, Absolute)
0x75	0x08		Report Size (8)
0x95	0x01		Report Count (1)
0x81	0x01		Input (Constant)
0x19	0x00		Usage Minimum (0)
0x29	0x91		Usage Maximum (145)
0x26	0xFF	0x00	Logical Maximum (255)
0x95	0x06		Report Count (6)
0x81	0x00		Input (Data, Array, Absolute)
0xC0			End Collection

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5.2 Default descriptor for mouse

The default report descriptor used by the BlueHID-P/DM firmware describes a 3 button wheel mouse and is defined as follows:

0x05	0x01	Usage Page (Generic Desktop Control)
0x09	0x02	Usage (Mouse)
0xA1	0x01	Collection (Application)
0x85	0x02	ReportID (2)
0x09	0x01	Usage (Pointer)
0xA1	0x00	Collection (Physical)
0x05	0x09	Usage Page (Button)
0x19	0x01	Usage Minimum (1)
0x29	0x03	Usage Maximum (3)
0x15	0x00	Logical Minimum (0)
0x25	0x01	Logical Maximum (1)
0x95	0x03	Report Count (3)
0x75	0x01	Report Size (1)
0x81	0x02	Input (Data, Variable, Absolute)
0x95	0x01	Report Count (1)
0x75	0x05	Report Size (5)
0x81	0x03	Input (Constant)
0x05	0x01	Usage Page (Generic Desktop Control)
0x09	0x30	Usage (X)
0x09	0x31	Usage (Y)
0x09	0x38	Usage (Wheel)
0x15	0x81	Logical Minimum (-127)
0x25	0x7F	Logical Maximum (127)
0x75	0x08	Report Size (8)
0x95	0x03	Report Count (3)
0x81	0x06	Input (Data, Variable, Relative)
0xC0		End Collection
0xC0		End Collection

This report descriptor specifies a 5 byte report with the following format:

byte nr.	definition
1	Report ID, always set to 2
2	3 bits status of buttons (0,7)
3	X axe (-127,127)
4	Y axe (-127,127)
5	wheel (-127,127)

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6 Low Power Modes

An active Bluetooth connection is put into sniff mode with a sniff interval of 30ms. After 7 seconds of inactivity the sniff interval is changed to 120ms. After approx. 5 minutes the link is disconnected.

Current consumption:

$T_{amb} = 25^{\circ}\text{C}$, all Output and Input lines except BONDABLE_ENABLE and /PWD_DISABLE disconnected

Mode	Power down	Average current / mA ($V_{CC}=3.3V$)
Idle – no connection, non bondable	disabled	6.8
	enabled	3.2
Idle – no connection, bondable	disabled	7.2
	enabled	7.2
sniff 30 ms interval	disabled	12.1
	enabled	12.1
sniff 120 ms interval	disabled	7.3
	enabled	7.3
connecting	disabled	41.3
	enabled	41.3

7 Compatibility

The firmware has been tested against the HID host implementation of the following products:

Product	Version
Widcom Bluetooth Application	V4.0.0.2401
Windows XP	SP2 V.2096
IVT BlueSoleil	V1.4.9 Stack V 04.03.11.20040827
Toshiba BtStack	V3.03.20

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8 Examples

8.1 Transfers from a keyboard using the transparent message format

A single keystroke of a '0' is signaled as:

Mtag	len	check	HID report								
04h	09h	0Dh	01h	00h	00h	27h	00h	00h	00h	00h	00h

The host system auto repeats a keystroke that's why a "no key pressed" information must be send if no other report is send:

Mtag	len	check	HID report								
04h	09h	0Dh	01h	00h	00h	00h	00h	00h	00h	00h	00h

A single keystroke of the Enter key is signaled as:

Mtag	len	check	HID report								
04h	09h	0Dh	01h	00h	00h	28h	00h	00h	00h	00h	00h

Keys '1', '2' and '3' pressed simultaneous is signaled as:

Mtag	len	check	HID report								
04h	09h	0Dh	01h	00h	00h	1Eh	1Fh	20h	00h	00h	00h

Shift 'a' is signaled as:

Mtag	len	check	HID report								
04h	09h	0Dh	01h	02h	00h	04h	00h	00h	00h	00h	00h

8.2 Transfers from a mouse using the transparent message format

Left movement by one

Mtag	len	check	HID report				
04h	05h	01h	02h	00h	FFh	00h	00h

Right movement by one

Mtag	len	check	HID report				
04h	05h	01h	02h	00h	01h	00h	00h

Up movement by one

Mtag	len	check	HID report				
04h	05h	01h	02h	00h	00h	FFh	00h

Down movement by one

Mtag	len	check	HID report				
04h	05h	01h	02h	00h	00h	01h	00h

Button 1 pressed

Mtag	len	check	HID report				
04h	05h	01h	02h	01h	00h	00h	00h

Button 1 released

Mtag	len	check	HID report				
04h	05h	01h	02h	00h	00h	00h	00h

Button 3 pressed while moving right

Mtag	len	check	HID report				
04h	05h	01h	02h	04h	10h	00h	00h

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9 History

Version	Release Date	By	Change description
0.5	14.09.2005	JW	first version
0.6	24.10.2005	JW	added chap. 8 Examples added HID report descriptor
1.0	09.11.2005	JW	added power consumption table modified HID report descriptor 5 LED's now changed Bluetooth Version to 1.2
1.1	13.12.2005	JW	enhanced list of tested HID-Host products added pull configuration to chap 3.3 GPIO interface new current values
1.2	21.02.2006	JW	tested against Linux BlueZ added Report ID to report descriptor, transparent message format and examples added firmware variant for mouse
	07.12.2006	TA	reworked format settings
r03	23.04.2007	KM	added description of UART_CTS and power down protocol
r04	28.11.2008	JW	new output signal BONDABLE_ACTIVE enhanced description for signal BONDABLE_ENABLE added description about bondable mode after start-up corrected disconnect time in chapter 6 Low Power Modes updated chapter 7 Compatibility
r05	20.07.2009	TA	added support of BlueMod+P2x/G2
r06	13.01.2010	JW	added new command Bluetooth address request / response added description of visibility added new disclaimer

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