XHC xHB03 & xHB04 INTERNALS

Characteristics			
MODEL	**DESCRIPTION**	**DRIVER**	**INITIALLY FOR**
WHB03 LHB03 	wireless mpg wired mpg	HID DEVICE VID: 0x10CE PID: 0xEB6E	NC Studio
WHB04 LHB04 	wireless mpg wired mpg	HID DEVICE VID: 0x10CE PID: 0xEB70	Mach 3

Power saving:

If you use wireless model of this device you need to know what each device will go sleep mode after 30 seconds if no button was pressed.

HID structure:

Device has two reports IDs one of it (Report ID: 04h) used as expected through writing to USB Endpoint 81h, another one (Report ID: 06h) used to HOST->DEVICE communication, but we do not have OUT endpoint in our USB Device Descriptor for it, it was first tricky place, device used HID SET_REPORT request and transfer data via 07h bytes chunks. Take a closer look for these reports.

Report ID: 0x04 DEVICE->HOST (6 bytes)			
offset	**size (bytes)**	**name**	**description**
00h	1	ID	report id (04h)
01h	1	BUTTON 1	button key code
02h	1	BUTTON 2	button key code
03h	1	WHEEL MODE	axes for wheel and etc
04h	1	WHEEL	signed value of wheel speed, sign - direction
05h	1	XORED DAY	current day XORed with button 1 key code

ID - it is our report ID according to HID report information.
BUTTON 1,2 – if we push da button we see our key codes in this fields. We can push TWO buttons simultaneously.

Key codes		
CODE	**HB03**	**HB04**
17h	Yes	Reset
16h	No	Stop
01h	Stop	Goto zero
02h	Start/Pause	Start/Pause

03h	Rewind(?)	Rewind
04h	Probe-Z	Probe-Z
0Ch	Goto zero	Spindle
06h	X/2=	1/2=
07h	Y/2=	0=
08h	Safe-Z	Safe-Z
09h	X=0	Goto home
0Ah	Y=0	Macro 1
0Bh	Z=0	Macro 2
05h	Goto home	Macro 3
0Dh	Step left	STEP++
0Eh	Step right	MPG/MODE
0Fh	Fine xyz	Macro 6
10h	Spindle	Macro 7

WHEEL MODE		
value	**HB03**	**HB04**
00h	off state	off state
11h	X direction for hand-wheel	X direction for hand-wheel
12h	Y direction for hand-wheel	Y direction for hand-wheel
13h	Z direction for hand-wheel	Z direction for hand-wheel
15h	adjust Spindle speed	adjust Spindle speed
14h	adjust Feedrate speed	adjust Feedrate speed
18h	adjust Processing speed	A direction for hand-wheel (used X axis)

WHEEL – it is direction and speed of wheel, when we spin the wheel to CW dir it will be positive from 1 to 10 (this value based on current spin speed) and when spin wheel to CCW value be negative from -1 to -10 (based on spin speed too)
XORED DAY - very interesting value, it is a crypted DAY OF THE MONTH this value settable with HID Set Feature and used as key for simple XOR crypt what used for very easy protection of they protocol and solved easily (XORED DAY) XOR (BUTTON 1).

Report ID: 0x06 HOST->DEVICE (8 bytes)			
offset	**size (bytes)**	**name**	**description**
00h	1	ID	report id (06h)
01h	7	PAYLOAD CHUNK	chunk of output data report

ID - it is our report ID according to HID report information.
PAYLOAD CHUNK – it is chunk of our payload, if we need to send data not aligned to 7 bytes we need to pad it for 7 bytes.

Payloads data:

HB03 (31 bytes)			
offset	**size (bytes)**	**name**	**description**
00h	2	MAGIC	FDFEh used to detect start sequences
02h	1	DAY	day of the month
03h	2	WC_X_INT	X workspace position integer
05h	1	WC_X_FRAC	X workspace position fractional
06h	2	WC_Y_INT	Y workspace position integer
08h	1	WC_Y_FRAC	Y workspace position fractional
09h	2	WC_Z_INT	Z workspace position integer
0Bh	1	WC_Z_FRAC	Z workspace position fractional
0Ch	2	MC_X_INT	X machine position integer
0Eh	1	MC_X_FRAC	X machine position fractional
0Fh	2	MC_Y_INT	Y machine position integer
11h	1	MC_Y_FRAC	Y machine position fractional
12h	2	MC_Z_INT	Z machine position integer
14h	1	MC_Z_FRAC	Z machine position fractional
15h	2	FEEDRATE OVR	feedrare override value
17h	2	SPINDLE SPEED OVR	spindle speed override value
19h	2	FEEDRATE	feedrate value
1Bh	2	SPINDLE SPEED	spindle speed value
1Dh	1	STEP MUL	step multiplier for hand-wheel
1Eh	1	STATE	notify user for something

HB04 (37 bytes)			
offset	**size (bytes)**	**name**	**description**
00h	2	MAGIC	FDFEh used to detect start sequences
02h	1	DAY	day of the month
03h	2	WC_X_INT	X workspace position integer
05h	2	WC_X_FRAC	X workspace position fractional
07h	2	WC_Y_INT	Y workspace position integer
09h	2	WC_Y_FRAC	Y workspace position fractional
0Bh	2	WC_Z_INT	Z workspace position integer
0Dh	2	WC_Z_FRAC	Z workspace position fractional
0Fh	2	MC_X_INT	X machine position integer
11h	2	MC_X_FRAC	X machine position fractional
13h	2	MC_Y_INT	Y machine position integer

15h	2	MC_Y_FRAC	Y machine position fractional
17h	2	MC_Z_INT	Z machine position integer
19h	2	MC_Z_FRAC	Z machine position fractional
1Bh	2	FEEDRATE OVR	feedrare override value
1Dh	2	SPINDLE SPEED OVR	spindle speed override value
1Fh	2	FEEDRATE	feedrate value
21h	2	SPINDLE SPEED	spindle speed value
23h	1	STEP MUL	step multiplier for hand-wheel
24h	1	STATE	notify user for something

MAGIC - magic value indicate what it is a first packet sequence and it is always **0**
xFDFE DAY - day of the month, it will read back as XORED DAY (see before)
***_*C_INT** - it is integer part of position without sign. Example:

value	result
135.17	135
-77.89	77

***_*C_FRAC** – has 8bit for HB03 and 16bit for HB04 it is simple when you look to display max frac part for HB03 it is .99 and for HB04 it is .9999 this value also have a SIGN bit if value is negative you must set most significant bit to 1, else drop it. Example:

value	device	result
-117.33	HB03	33 OR 80h
-220.334	HB04	3340 OR 8000h

FEEDRATE OVR – display our feedrate override value
SPINDLE SPEED OVR - display our speed override value
FEEDRATE - current feedrate
SPINDLE SPEED - current speed
STEP MUL - it is step multiplier for our hand-wheel. If we change it in software we can show this value to user. It divided into two part low and hi nibble.

Low nibble	
value	**description**
0x00	0*1x
0x01	1*1x
0x02	5*1x
0x03	10*1x
0x04	20*1 x
0x05	30*1 x
0x06	40*1 x
0x07	50*1 x
0x08	100*1 x
0x09	500*1 x

Hi nibble	
value	**description**
10h	back to origin
20h	floating on the knife(?)
50h	back to mechanical origin
60h	fine adjustment

0x0A	1000*1 x			
0x0B	special?(hb04)			

STATE - this is state value, used to notify user of state of our machine or if you need something from user.

value	description
0x01	run state blink
0x02	pause state blink
0x20	xhb04?
0x40 (0x80)	flash yes/no leds (HB03 only ?)

Changelog:

09 /01/2014 - initial release

13/01/2014 – add key codes, fix hb04 wheel modes