USB JOYSTICK INTERFACE DATA SHEET

Pt. No. 909999-A Drawn: K. Meneely 16/2/06

The Apem Components USB Joystick Interface is designed to connect a Joystick with up-to 3 axes and 8 buttons to a USB port on a PC or Mac.

We have utilised a 'JoyWarrior' controller chip from Code Mercenaries for controlling the USB interface.

The interface is Fully USB V1.1/2.0 and HID 1.1 compliant. It is compatible with standard system drivers, so no special drivers are required.

There are 3 analog inputs for X, Y and Z axes with 10 bit resolution and connections for up-to 8 pushbuttons.

The interface board measurements and mounting points are shown below:
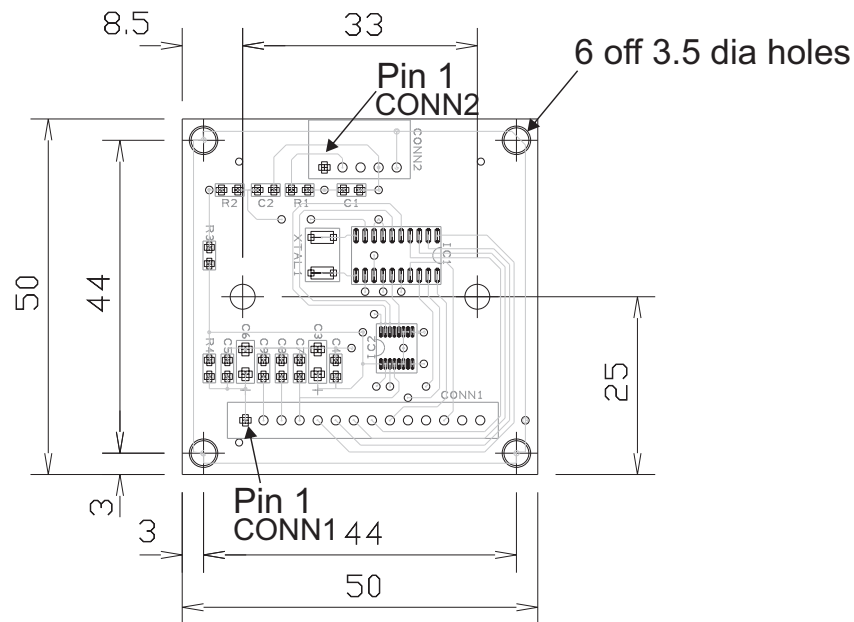
USB connection is made via a 5 way Molex KK style header on the board. A Suitable USB cable (1.5m long) is also available - Part number 919998. The joystick connects to Conn1, a 14 way molex KK style header. Please refer to the pin-outs below:

Conn 2 (USB) :   Pin 1 +5V
                   Pin 2 D-   Note: The 4 external mounting holes are
                   Pin 3 D+   connected to the USB cable screen
                   Pin 4 0V
                   Pin 5 Screen

Conn 1 (Joystick) Pin 1 +V ref   Pin 8   Switch 4
                   Pin 2 X Axis   Pin 9   Switch 5
                   Pin 3 Y Axis   Pin 10 Switch 6
                   Pin 4 Z Axis   Pin 11 Switch 7
                   Pin 5 Switch 1   Pin 12 Switch 8
                   Pin 6 Switch 2   Pin 13 0V
                   Pin 7 Switch 3   Pin 14 Screen

Device Operation

By following the USB HID specifications JoyWarrior chips are able to work with most operating systems without the need to supply special drivers. Any operating system with support for USB HID game controllers will have the necessary drivers already in place.

Operation with Windows

Any Windows versions 98 and newer and 2000 and newer will work with JoyWarrior. Older versions of Windows do not support USB.

Upon connecting a JoyWarrior based device for the first time you will be asked to perform the standard driver install. The same happens if you connect the device to a different USB port on the same computer.

After the driver installation has completed you should be able to see the device in the "Game Controllers" control panel and be able to access it via DirectInput.

Operation with MacOS

MacOS 9.0 and up and MacOS X do support JoyWarrior direct. Some versions of MacOS 8.x do support USB as well, though their use is not recommended.

With MacOS 9.x you will be able to use JoyWarrior based devices via InputSprocket or with 3rd party software like USB Overdrive.

On MacOS X access is available via the HIDManager.

There will be no warnings or dialogs when a properly functioning JoyWarrior based device is connected under MacOS, it will simply start to work.

Remote Wakeup

All JoyWarrior chips support the remote wakeup feature. They are able to wake the host computer from sleep state if the host operating system does enable this feature.

Remote wakeup is initiated by JoyWarrior if any button is pressed or if any switch of the direction pad closes. Changes on the analog axes are not detected.

For remote wakeup to be functional on the JoyWarrior20 chips the RC combination on the CExt pin as specified in the application circuits is required.

When remote wakeup is active and the USB is in suspend state JoyWarrior20 will wake periodically and check if any switches are closed, if not it will immediately return to suspend mode.

Joystick axis orientation

USB specifies the axis orientation as follows:

For the X axis values should increase for left to right movement, Y axis values increase for far to near movements (i.e. pulling the stick gets you larger values), Z axis values should increase for high to low movement.

Non Joystick Applications

USB does allow a Human Interface Device controller to very detailed specify the function of axes and buttons. This gives a game controller device the option to specify a certain axis to be a throttle or break or something else.

The standard JoyWarrior chips are for general use, so the analog axes variants just specify X, Y, Z and the switch inputs are defined as being just buttons.

V 1.0.3, July 25th 2005 for Chip Revision V1.0.3.x

DC Characteristics

	Parameter	Min	Max	Units	Remarks
V_{cc}	Operating Voltage	4.35	5.25	V	
I_{cc}	Operating Supply Current		25	mA	
I_{sb}	Suspend mode current		20	¢A	Oscillator off
I_{ol}	Sink current on output pins	8	24	mA	Vout = 2.0V
R_{up}	Pull-up Resistance	8	24	kΩ	
V_{ith}	Input Threshold Voltage	45%	65%	Vcc	
	USB Interface				
V_{oh}	Static output high	2.8	3.6	V	15kΩ□5% to GND
V_{ol}	Static output low		0.3	V	
V_{di}	Differential Input sensitivity	0.2		V	|(D+)-(D-)|
V_{cm}	Differential Input common Mode Range	0.8	2.5	V	
V_{se}	Single Ended Transceiver Threshold	0.8	2.0	V	
C_{in}	Transceiver capacitance		20	pF	
I_{io}	Hi-Z State Data Line Leakage	-10	10	¢A	0V < Vin < 3.3V, Hi-Z State
R_{pu}	Bus Pull-up resistance	7.35 *	7.65 *	kΩ	7.5kΩVcc
R_{pd}	Bus Pull-down resTstance	14.25	15.75	kΩ	15kΩ¢ 5%

AC Characteristics

	Parameter	Min	Max	Units	Remarks
t_{cyc}	input clock cycle time	165.0	168.3	ns	
t_{ch}	Clock high time	0.45tcyc		ns	
t_{cl}	Clock low time	0.45tcyc		ns	
	USB Driver Characteristics				
t_r	Transition rise time	75		ns	CLoad = 50pF
t_r	Transition rise time		300	ns	CLoad = 350pF
t_f	Transition fall time	75		ns	CLoad = 50pF
t_f	Transition fall time		300	ns	CLoad = 350pF
t_{rfm}	Rise/Fall Time matching	80	120	%	
V_{crs}	Output signal crossover voltage	1.3	2.0	V	
	USB Data Timing				
t_{drate}	Low Speed Data Rate	1.4777	1.5225	MBit/s	
t_{djr1}	Receiver data jitter tolerance	-75	75	ns	To next transition
t_{djr2}	Receiver data jitter tolerance	-45	45	ns	For paired transitions
t_{deop}	Differential to EOP transition skew	-40	100	ns	
t_{eopr1}	EOP width at receiver	165		ns	Rejects as EOP
t_{eopr2}	EOP width at reeiver	675		ns	Accepts as EOP
t_{eopt}	Source EOP width	1.25	1.50	Os	
t_{udj1}	Differential driver jitter	-95	95	ns	To next transition
t_{udj2}	Differential driver jitter	-150	150	ns	To paired transition

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USB VendorID and ProductID

By default all JoyWarrior chips are shipped with the USB VendorID of Code Mercenaries ($7C0 or decimal 1984) and a fixed ProductID.

On request chips can be equipped with the customers VendorID and ProductID. VendorIDs can be obtained from the USB Implementers Forum <www.usb.org>

Customized chips are subject to minimum order quantities, contact <sales@codemercs.com> for details.

Following is the ProductID for the JoyWarrior controller:

JoyWarrior20 A10-8 $1108

Product IDs are independent of the package type.

Currently shipping version

JoyWarrior20 A10-8   V1.0.3.3

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USING THE JOYSTICK TO CONTROL THE MOUSE POINTER

There is a software utility availably to download from the internet that allows the Joystick interface to control the mouse pointer. Please refer to the Virtual Projects Website http://www.vp-soft.com/software/joymouse.php for details on their 'Joymouse' software.

JoyMouse is the utility program which makes any standard joystick act like a mouse device.
It means when you move joystick axis mouse pointer starts to move in the same direction.
Pointer speed depends on the joystick's position. Joystick buttons by default are mapped to
Left click, Right Click, Double Click and Alternative Speed, but you can easily change all the mappings.
As an additional functionality, pointer can wrap through the display edges, go in reverse and gain some latency amount.

Application is just perfect suit for:

Browsing the web
Playing the games which originally does not support joystick
Using instead of a mouse, if you don't like the mouse, or cannot use it for some reasons
Many other excited things to do when you're at your computer

System requirements:
1) MS Windows 95, 98, ME, NT, 2000 or XP
2) 4Mb of free hard drive space
3) Microsoft compatible Joystick (optional)

Key features:
Complete mouse device replacement using joystick or keyboad!
Customiseable joystick button mappings
Configuration wizard
Possibility to invert mouse axes
Possibility to add latency (filter) to the pointer movement
Adjustable pointer speed
Possibility to make mouse pointer wrappable through the screen edges