Hardware and Electronics Reference

for the

Palm® and Stowaway™ Portable Keyboards

Revision 1.1

www.thinkoutside.com

Pin Assignments for Handspring Visor Handhelds

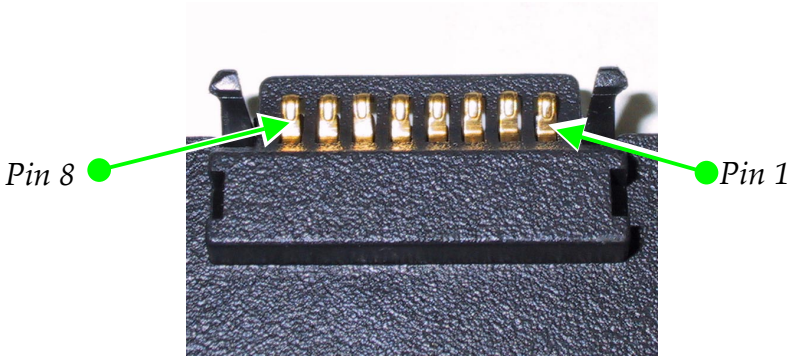

Figure 2: Connector for Handspring Visor Keyboards

The pin assignments are:

Pin 8	**VCC / TXD**
Pin 7	N/C
Pin 6	N/C
Pin 5	N/C
Pin 4	**GROUND**
Pin 3	N/C
Pin 2	N/C
Pin 1	**RXD** – Output from keyboard (receive serial line to device).

VI. Interface Details

Here are the communications and interface details for the keyboards. Note the differences between the Palm / PocketPC keyboards and the Handspring keyboards.

Communications Interface

Communications interface details for all keyboards:

- 9600 bps
- 8 Data Bits
- No Parity Bit
- 1 Stop Bit
- Includes a start bit which is always in communication.

Palm and PocketPC Keyboards	Handspring Keyboards
Data is sent at **RS-232** level.	Data is sent at **TTL** level.

Basic Signal Interface

Minimum set of signals required for keyboard functionality.

- **GROUND** – the connection to ground from the PDA or controlling device.
- **VCC or DTR** – Power connection from the PDA or controlling device. The voltage level can be 3.0V DC to 5.5V DC. Power consumption is no more than2.5 mA when a key is depressed and less than 5 μA when the keyboard is sitting in power save mode.
- **RXD** – Receive data signal from the keyboard to the PDA or the controlling device. The signal is generated from the drain of a MOSFET transistor which inverts the signal from the keyboard microcontroller. This line is reliant on a pull-up resistor (100k) internal to the PDA or controlling device.

Handshake Signal Interface

Palm and PocketPC Keyboards	Handspring Keyboards
DCD (PocketPC ActiveSync or Palm HotSync): • Available for handshake keyboard detection. • When the keyboard first sees power, or a key is depressed while the attached keyboard is in low power mode, the keyboard pulses the HotSync / DCD signal. • See section on ***Keyboard Detection*** for details. • SIGNAL LEVELS – Data may be sent at RS-232 levels. The signal level depends on the input voltage supplied by the device.	Handshake signal is **NOT** available.

Signal Transmission

Data which is sent across the RXD signal is sent least significant bit (LSB) first and most significant bit last (MSB). This is standard with RS-232 serial transmission.

Palm and PocketPC Keyboards	Handspring Keyboards
No special notes.	Data is sent in TTL format, not RS-232 format. For example, logic level 1 is HIGH for this transmission, whereas in a full fledge RS-232 serial transmission the data is sent inverted and the RS-232 transceiver at in the device handles it.

Detecting Keyboards for Handspring Devices

If you are developing for a ***Palm or PocketPC*** keyboard, please skip this section and refer to the previous section, ***Detecting Keyboards for Palm and PocketPC Devices***.

CHECK FOR KEYBOARD ON POWER UP:

The keyboard electronics are powered up when the signal on the VCC line jumps from low to high, typically by power cycling a device attached to the keyboard.

Approximately 12-15 milliseconds after the keyboard electronics are powered up, the keyboard will send an ID string of two bytes over the RXD line. The hex ID string is:

F9 FB

Your driver must be ready to receive this ID to detect the keyboard. Typically, you would open the serial port during the power up sequence of your device to prepare your driver for receiving this ID.

The serial port should stay open until the power is turned off, or until the keyboard is detached. ***Note that there is no handshaking involved.***

CHECKING FOR DETACHED KEYBOARD:

There is no dedicated line to indicate a detached keyboard. To check for a detached keyboard, toggle the VCC / TXD line (lower then raise the signal). An attached keyboard will return the ID string (**F9 FB**) on the RXD line. If no ID string is received, your keyboard has been detached, and you should close the serial port.

Your driver should check for a detached keyboard:

- **At Regular Intervals** - For example, the Think Outside driver for the Handspring Keyboard checks for a detached keyboard every 30 seconds.
- **During Key Repeat** - Your driver should also check for a detached keyboard during key repeat (for example, after every 10 keys).

Checking for a detached keyboard during key repeat precludes this type of scenario: The user depresses the Delete key and holds it to repeat. The keyboard is jostled and becomes detached. Since the key up code for Delete key was never detected, the delete is free to continue to repeat until the entire text field is deleted. However, if the driver checks for the detached keyboard after every 10 keys, the damage is limited to 10 deletes.

Note: If keys are depressed when the when power is applied, the keyboard will also send the key codes of all depressed keys addition to the ID string.

Keystrokes

Keyboard correctly transmits keystrokes at a rate up to 10 keys per second, and buffers up to 6 keystrokes:

- **Rate**: Up to 10 keys / second.
- **Buffer**: Up to 6 keys.

Key Down Code – When a key is depressed, one 8-bit byte is sent:

- Most significant bit: 0 for Key Down.
- Next four bits: Y Address for Key (Y0 through Y11)
- Least Significant 3 Bits: X Address (X0 through X7)
- Y & X addresses are specified in the ***Key Code Matrix***.

Key Up Code – When a key is released, one 8-bit byte is sent:

- Most significant bit: 1 for Key Up.
- Least Significant 7 Bits: Y & X Addresses, same as Key Down.

Last Key Up - When no other keys are depressed at the time a key goes up, the 8-bit byte for that key up is sent TWICE.

Example 1: Type the letter "a". The keyboard will send one key down code for the "a" key, followed by two key up codes.

Example 2: Type a Shift-A. The byte sequence may look something like this:

- One key down code for the left Shift key.
- One key down code for the "a" key.
- One key up code for the "a" key (left Shift key is still depressed).
- Two key up codes for the Left Shift key (last key up).

IMPORTANT - When your driver receives the second key up code for a Last Key Up, CLEAR ALL MODIFIER FLAGS.

Phantom Keys

A phantom key situation occurs by simultaneously pressing three keys that form three corners of any square or rectangle in the key matrix.

The phantom key algorithm is based on a 3-key rollover algorithm. If three keys are depressed and held down simultaneously that form a phantom key situation, key down codes will be sent for the first two keys to be depressed.

The key down code for the third key that was depressed will NOT be sent until either one of the first two keys is released.

2 and 3 Key Rollover

The keyboard can detect any two or three keys that are depressed simultaneously, provided that the three keys pressed simultaneously do not comprise three corners of a rectangle in the key matrix. This is covered by the phantom key algorithm.

Modifier Key Combinations

The keyboard firmware only transmits key coordinates, key down, and key up information. Modifier key combinations are treated the same as any other 2-key or 3-key rollover combinations.

Power Consumption

- Less than 5 μA in sleep mode.
- Less than 2.5 mA while key(s) is pressed.

Filters Key Bounce

- 15 - 25 milliseconds.

VII. Key Code Matrix

	X0	X1	X2	X3	X4	X5	X6	X7
Y0	! 1	@ 2	# 3	Z	$ 4	% 5	^ 6	& 7
Y1	CMMD	Q	W	E	R	T	Y	~ `
Y2	X	A	S	D	F	G	H	Space 1
Y3	CAPS LK	TAB	CTRL					
Y4			FN	ALT				
Y5					C	V	B	N
Y6	_ -	+ =	BACK SP	*Special Function One*	8	9	0	Space 2
Y7	{ [	{]	| \	*Special Function Two*	U	I	O	P
Y8	" '	ENTER	*Special Function Three*		J	K	L	: ;
Y9	? /	*Scroll Up* (up arrw)	*Special Function Four*		M	< ,	> .	DONE
Y10	DEL	(lt arrw)	*Scroll Dn* (dn arrw)	(rt arrw)				
Y11	SHIFT(L)	SHIFT(R)						