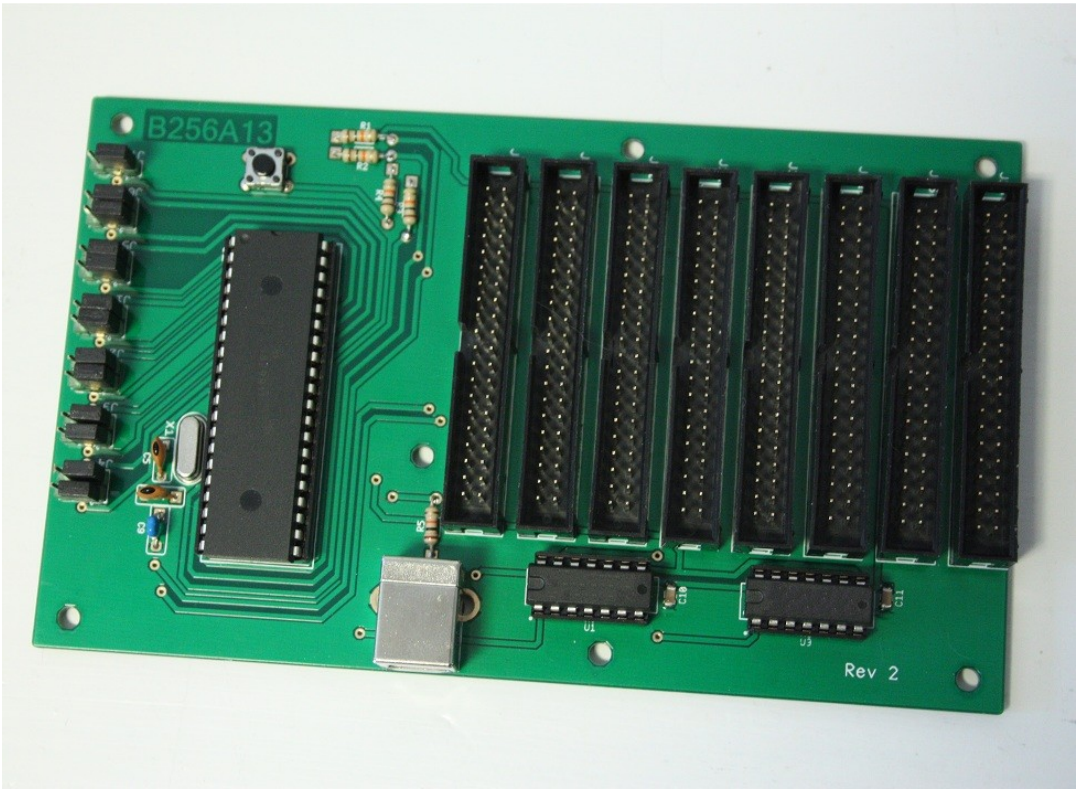
B256A13

High Input Count Joystick Controller



User Manual
Rev. 1

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1 Features

- USB 2.0
- Firmware upgrade over USB
- Uses standard HID drivers included with most PC operating systems. No software installation required.
- Button matrix with 256 digital inputs allows for connection of up to 248 switches and two 8-way POV hats.
- 13 analog inputs with 10-bit resolution and advanced digital filtering allow for connection of 13 potentiometers or other devices with a 0-5 V analog output.
- Seen as two HID Joysticks in Windows allows for direct support in games that handle 128 buttons and 8 axes per joystick.
- One separate pin for each input allows for much easier connections than most matrix-based input boards while still maintaining the great wiring advantages that a matrix brings. All 256 inputs can be used with only 32 wires going to the board.
- 40-pin connectors keep the number of connectors to a minimum which let you unplug the whole joystick controller in just a few seconds and minimize the risk of putting it back in the wrong way.

2 Hardware installation

The only step required is to plug in an USB A to B cable between the B256A13 and the computer. Drivers should install automatically and the board should be ready for use right away.

3 Digital inputs

The digital inputs are matrix-based, which means that when you need to short two pins together to get the corresponding input ON, and leave them open to get the corresponding input is OFF. This is the case with all matrix-based input boards, and it means that the inputs can only be used with equipment made to short two lines together (for example buttons and switches) and not with equipment that outputs a digital signal (for example 0 V/5 V).

The other thing you need to know about a matrix is that for each input a diode will be required. This diode will need to have a forward voltage drop of less than 0.8 V at 0.5 mA of current. The regular 1N4148 or a schottky diode will work fine. These can be bought at almost every shop that sell electronic components and the cost is between 0.005 and 0.01 USD when you buy them in larger quantities (50-100 pcs). Examples of how to wire up different switches will be shown later in this manual.

The numbering of the digital inputs can be seen in Image 1. The four connectors to the left correspond to the first virtual joystick while the four connectors to the right correspond to the second virtual joystick. Every column has 16 inputs (starting with I) and one common (starting with C) copied on four pins. Shorting one of the inputs to the common in the same column will signal the corresponding button as pressed to the computer. The shorting must go through a diode oriented with the anode towards the input-pin and the cathode (marked side) towards the common-pin. Every closed path from an input-pin to a common-pin must have a diode in series. The diodes are there to prevent a direct short-circuit between two input-pins.

Inputs I125 through I128 is for the POV hat on the joystick. The UP-switch connects to I125, the RIGHT-switch connects to I126, the DOWN-switch connects to I127 and the LEFT-switch connects to I128.

Important! Remember to check which wire goes to which pin in your connector before you start soldering. On a regular 40-way flat-cable connector the two columns on the board will be merged together in the cable so that the top wire goes to the top pin in one of the two columns while the second wire goes to the top pin in the other column, and then continues to alternate in that way.

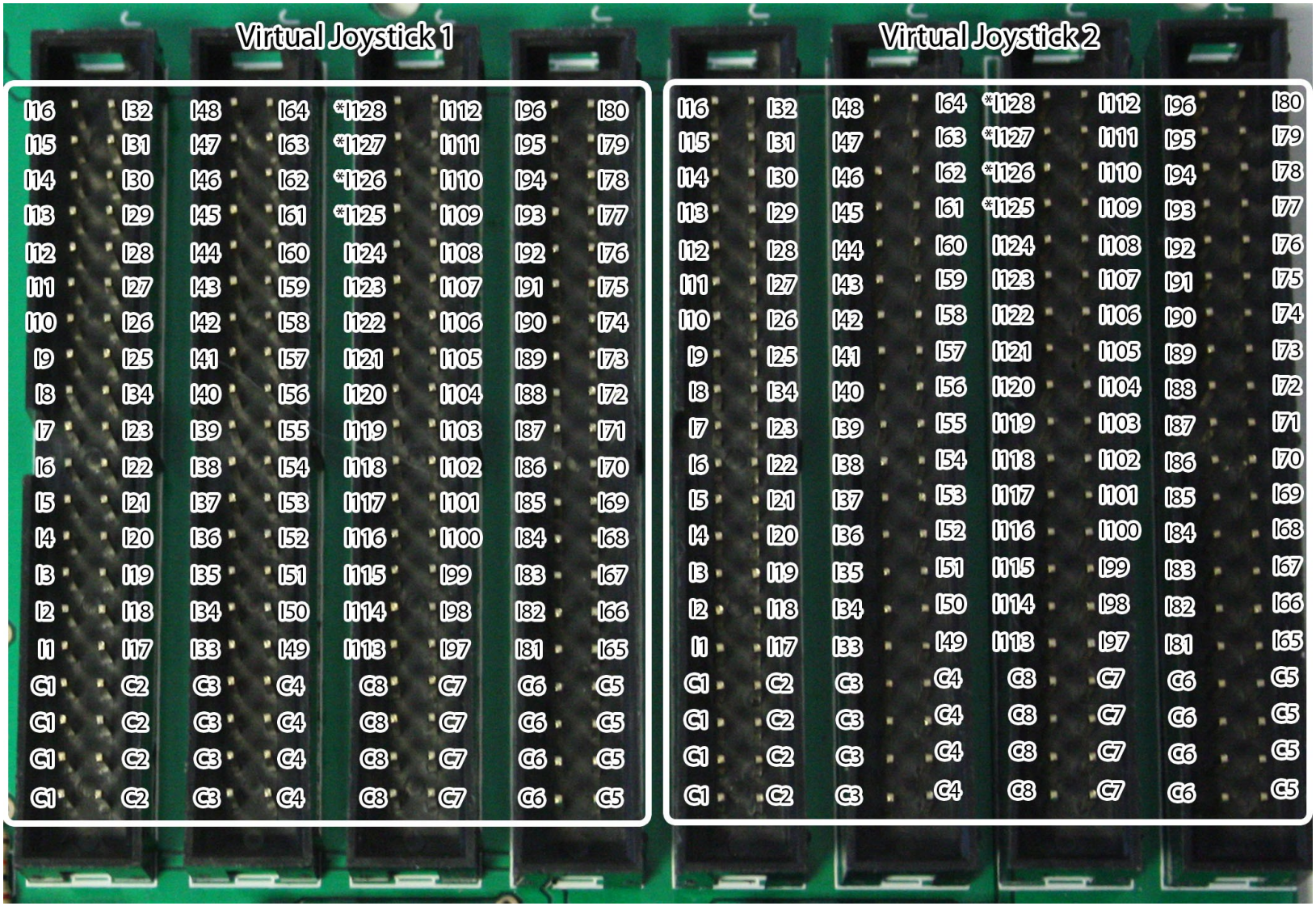

Image 1: Digital inputs numbering.

**These inputs are dedicated to the POV hat. More information is in the text.*

3.1 Connecting ON-OFF switches and pushbuttons

Soldering a diode from one input-pin to one common-pin will as previously stated make the corresponding button go to the pressed-state. That will not be of any use however, since the input stays pressed all the time. To connect an SPST-switch all you need to do is put the switch after or before the diode as in Image 2.

Important! If you place the diode between the switch and the common-pin, remember that although several switches can share the same common-pin they can NOT share the same diode! Image 3 illustrates this.

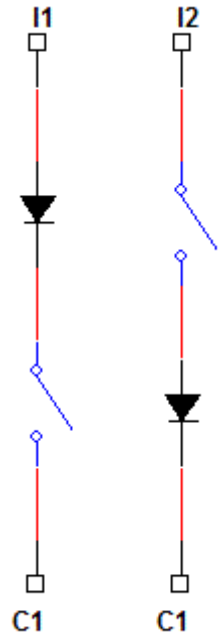

Image 2: SPST switches

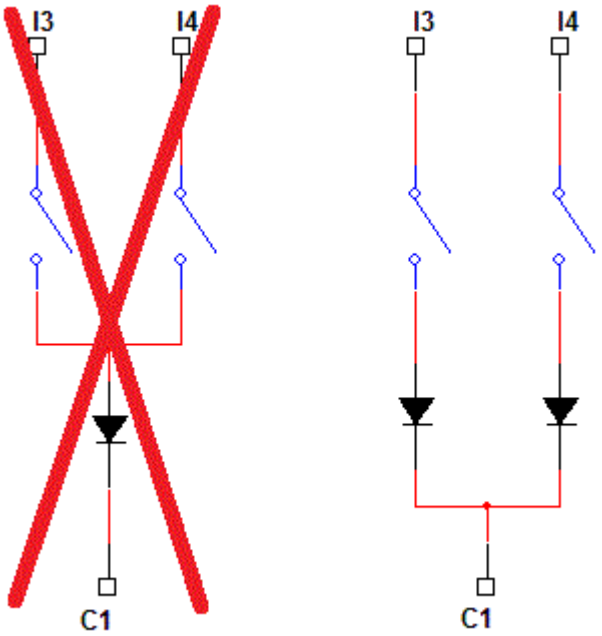

Image 3: SPST shared common

3.2 Connecting ON-ON and ON-OFF-ON switches

The connection should be as shown in Image 4. With ON-ON switches, you should consider if you really need to connect both inputs. Obviously it uses one more input, and it may be possible to configure the application to execute one command when the switch turns ON and another command when the switch turns OFF. In that case you could wire up the switch as a regular ON-OFF switch by only connecting the switch's common and one of the two other terminals.

In the example in Image 4 we save one diode by connecting the diode between the common-pin on the switch and the common-pin on the board. This works because the switch can never short both inputs to common at the same time. This concept works for switches with more positions as well, like a rotary switch (not to be mixed up with a rotary encoder, which is a different thing). If only one input can be connected to the switch's common-pin at any given time, the diode can be placed on that side of the switch. However, if you have a switch that internally consists of many separate switches where several of them can be on at the same time, you need to place the diodes so that there is a diode for every one of those switches.

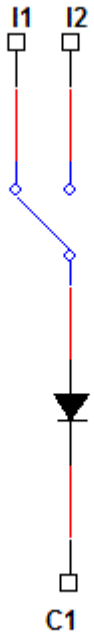

Image 4: SPDT switch