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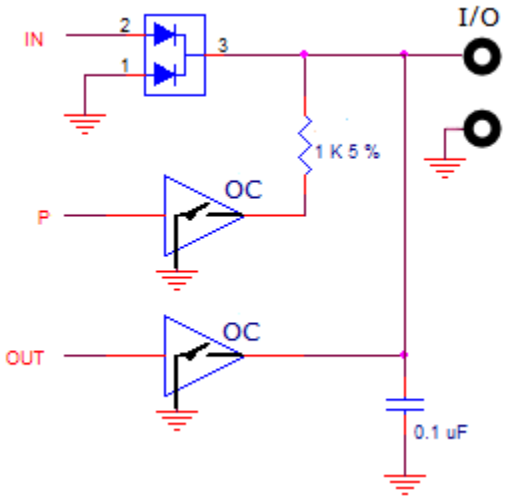
Using the HR-4P to interface with motorized screens with low-voltage control option

1.0 Understanding the IO ports of the HR-4P

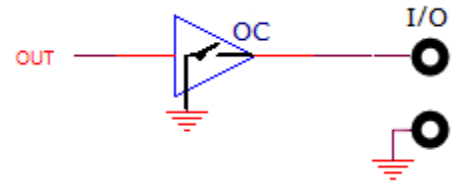
The HR-4P has 4 I/O pins. The direction or sense of each I/O pin is determined by the user. The pin can be defined either as an output, or as two kinds of input.

The internal circuit that is connected to each of the I/O pins is shown below:



The two triangle looking parts shown have open-collector (OC) outputs. So basically they are transistors that function like a contact to ground. In the above diagram we have drawn a switch contact inside each device to illustrate this. When open, the output can swing all the way to maximum of 30 vDC, and when closed, it can sink a max current of 30 ma. Note that the output cannot go below ground or damage will occur. As you can see there is a protection diode (pins 1&3) to protect the OC devices from negative output.

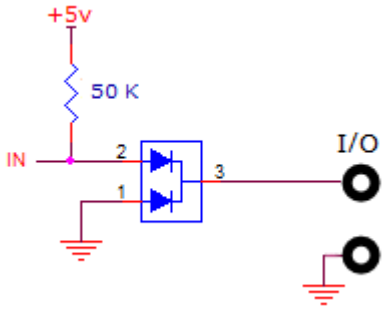
When the IO pin is configured as an output, the circuit basically looks like this:



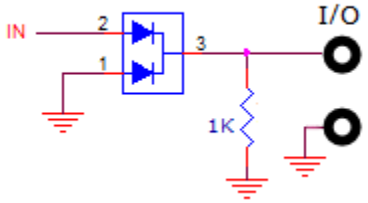
So in this mode the output acts as a dry contact, but the user has to make sure that:
(a) When open, the voltage at the output is between 0 ~ 30 vDC (not AC and never negative), and
(b) When closed the max current in to the IO pin is less than 30 ma

When the I/O pin is configured as an input, the HR-4P will check the state of the pin labeled IN to see if it is high or low. Furthermore, the user can make the input mode be Input Contact or Input Voltage.

If configured as Input Contact, the unit can sense an output short/open to ground. No external pull-up resistor is needed, but if the external device pulls the signal up, it is okay as long as it is less than 30 volts diode 2&3 protects the input. The following is equivalent circuit in this mode:



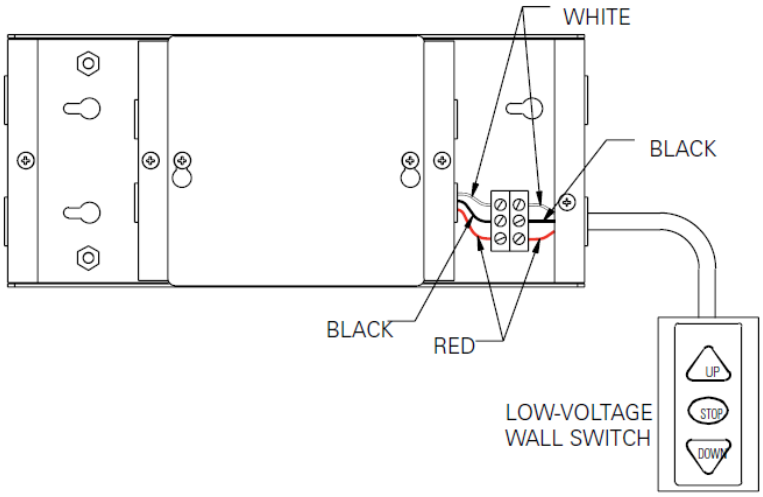
When configured as Input Voltage, the unit basically adds a 1K resistor to ground. So the external circuit that you are trying to sense has to be able to pull the signal high. An example of this is to sense presence of high voltage AC by using a small DC power adapter plugged in to the AC. Then when the AC turns on the power supply voltage is high and the HR-4P can sense that, but when the AC is off, the 1K resistor helps bleed the supply down to ground to bring the voltage down for the HR-4P to sense a low.



2.0 Using the HR-4P to control an external device

In this example we are going to assume that the HR-4P is going to control a motorized screen that has low voltage control (LVC) capability.

A typical unit looks like this:

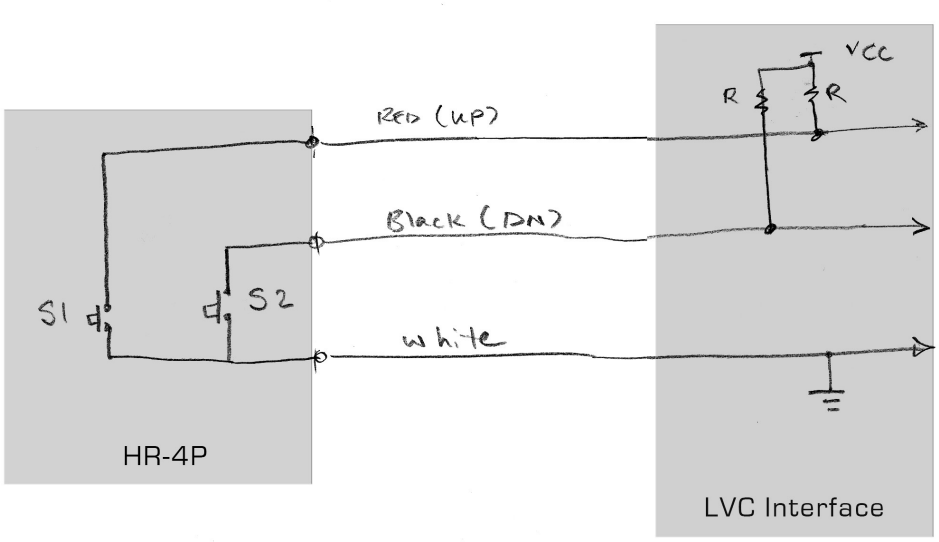


Let's assume that we want to replace the low voltage wall switch with the HR-4P, and presumably use RS-232 commands to HR-4P to control the screen operation.

The manufacturer specifies that:

- To start the UP motion, you must momentarily (0.5 sec) short Red and White wires
- To start the DOWN motion, you must momentarily short Black and White wires
- To stop motion at any point you must momentarily short Red and Black wires to the White wire

We can use two of the HR-4P's discrete I/O pins to achieve this. From the description given it appears that we may be able to directly interface to the LVC as shown below.



But before making the above connections we have to check the open circuit voltage and the short circuit current to make sure they don't exceed the HR-4P's ratings.

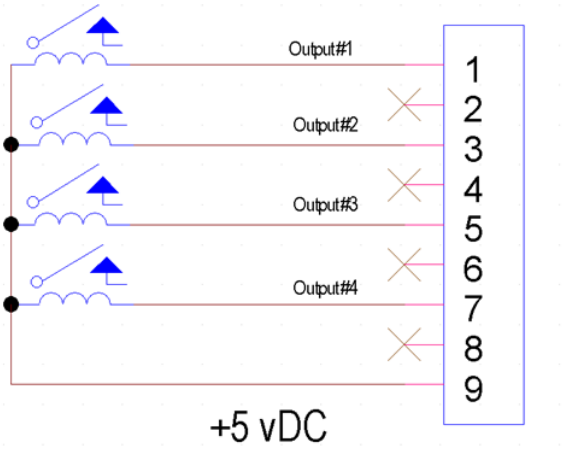
One way to do this is to check the mfg's documentation and find out what Vcc and R values are in the above image, and if such information is not given we must contact the screen vendor technical support.

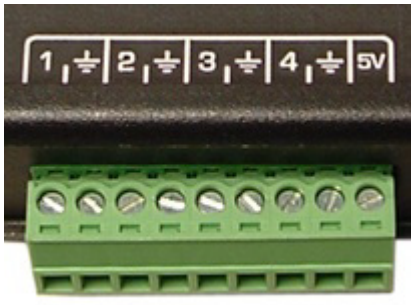
Another way is to measure those directly. In the above diagram before connecting the HR-4P, use a voltmeter (DVM) and measure the DC voltage between the red (or black) wires and the white. Make sure the voltage is positive and less than 30v DC. In the unlikely event the LVC interface is using low voltage AC signals, put the DVM in AC voltage and make sure there is no AC voltage between red (or black) wires and the white wires!

Most likely the DC current is not going to exceed 30 ma. But to make sure you can use the DVM in milliamp mode (may have to move the probe to Current terminal). Then connect the DVM between the Red and the White wires and note the milliamp reading.

If the open circuit voltage or short circuit current exceeds the rating of HR-4P then we need to use external relays (mechanical or solid state) to isolate the HR-4P and externally create the control signal or closure.

The output terminal strip on the HR-4P provides a +5V output for this purpose so you can easily use external relays to control high voltage AC or DC devices as shown below:





The maximum current available from the 5v terminal is approximately 160 ma.

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