5.1 - Analogue Inputs

About Analogue Inputs

While digital input devices provide a high or low potential to a microprocessor input pin, analogue input devices provide a range of meaningful values instead. The analogue input potential from some devices can vary from 0-5V, while other devices produce a more restricted range of potentials.

Analogue input - Phototransistor activity

1. Q1 and Q2 are phototransistors – components which change their resistance in response to light. Obtain a phototransistor and measure its resistance in forward and reverse orientation, in dark and light conditions. Shield the phototransistor from light with your hand to get a dark measurement, and aim the phototransistor at a light source or window for the light measurement.

   R_{Q1} (fwd-dark) = R_{Q1} (fwd-light) =

   R_{Q1} (rev-dark) = R_{Q1} (rev-light) =

2. Draw a phototransistor bias circuit, composed of a 10 kΩ resistor and a phototransistor connected in forward bias, connected to a 5 V potential. Note the polarity of the pins.

3. Build the phototransistor circuit you drew on a breadboard, and measure the potential drop across the phototransistor in dark and light conditions.

   E_{Q1} (dark) = E_{Q1} (light) =

4. Using the brightest light source available in the room, or an infrared LED aimed at the phototransistor, record the minimum potential drop across the phototransistor.

   Teacher Check ☐

Analogue input - Potentiometer activity

5. A potentiometer is a three-terminal variable resistor constructed as a potential-divider. The central connection of the potentiometer, called the wiper, moves along a resistive path to divide it into two adjustable parts while keeping the total resistance from end-to-end constant.

   Re-draw the schematic symbol of potentiometer VR1, along with its power supply and ground connections, below:

6. **Install VR1 and R19 into your CHRP board.**

   Set VR1's wiper to approximately the middle position. Measure the resistance from the wiper terminal to each end terminal. Then, connect power to your CHRP board and measure the VR1's output potential at R19.

Middle Position	R_{Left} =	R_{Right} =	E_{VR1} =

   Repeat the measurements with the potentiometer turned all the way counter-clockwise as well as all the way clockwise:

Counter-clockwise	R_{Left} =	R_{Right} =	E_{VR1} =
Clockwise	R_{Left} =	R_{Right} =	E_{VR1} =

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Analogue Input Analysis

7. R11 and R12 form a potential divider. What amount of +VM input potential is needed to produce a 5V potential across R12, at the middle of the potential divider?

8. Look up the data sheet for T1. When the temperature changes by 1ºC, how much does the output of temperature sensor T1 change?

9. An 8-bit A-D converter represents analogue input potentials as digital numbers. If 5V is equivalent to the number 255, calculate the potential equivalent to each digit (step).