CEG499/699-13: INTELLIGENT SENSOR SYSTEMS
LABORATORY I: SENSOR INTERFACING

In this laboratory you will develop two basic interface circuits for a temperature sensor (LM335) and a metal-oxide gas sensor (SB15).

SECTION 1: TEMPERATURE SENSOR

The LM335 temperature sensor is a zener diode whose breakdown voltage is proportional to absolute temperature. In this section you will build an excitation circuit for the sensor and an amplification circuit to increase sensitivity.

1. Connect the LM335 sensor in the 3-pin socket of the ISS interface board. The notch should point towards the right, as shown in Figure 1.
2. Using the T+ and T- pins of the 11-pin connector on the left of the breadboard, which are connected to the appropriate sensor pins through the PCB, connect the load resistor R_L in series with the LM335 sensor to 12VDC, as shown in Figure 2. Make sure the sensor responds to temperature.
3. Using the INA2126 instrumentation amplifier, implement the circuit shown in Figure 2. Notes:
    a. Take a look that the INA2126 data sheet to connect pins 5 and 7, reference and sense, respectively (not shown in Figure 2)
    b. Power the IC with ±12VDC (not shown in Figure 2)
4. Calibrate the sensor:
    a. Adjust the baseline-offset potentiometer (R_B) so that the output V_{out} of the instrumentation amplifier is zero at room temperature.
    b. Adjust the gain potentiometer (R_G) so that V_{out} is 3V at 50C.

SECTION 2: GAS SENSOR

The SB15 metal-oxide gas sensor is a chemo-resistor whose resistance changes when exposed to volatile organic compounds (i.e., hydrocarbons). In this section you will build an interface circuit to excite the sensor with constant heater voltage and measure resistance changes using a voltage divider.

1. Connect the SB15 in the top-left socket of the ISS board, as shown in Figure 1.
2. Connect 5VDC to the H1 pin on the 11-pin connector. This will provide power to the heater driver circuits.
3. Adjust the heater voltage between 0V and 0.8V by turning the pot on the corresponding limiter circuit on the bottom of the ISS board. This voltage can be measured on the top-left pin of each gas sensor socket (labeled H in Figure 1)
4. Connect the load resistor R_L (2kΩ) in series with the sensing element. Pin S1 on the 11-pin connector is directly connected to the sensing element (pin 2 in Figure 3).
5. Expose the gas sensor to a volatile organic compound (i.e., rubbing alcohol) and observe the changes.

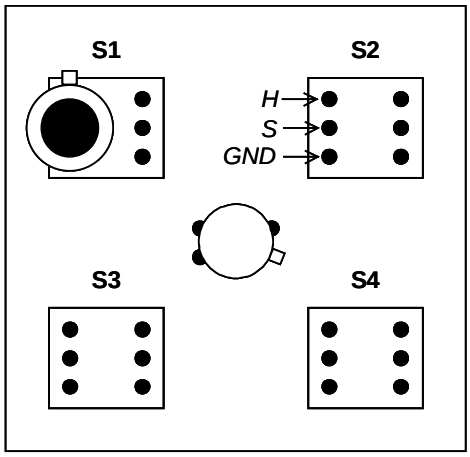

Figure 1. Placing the sensors on the chamber sockets

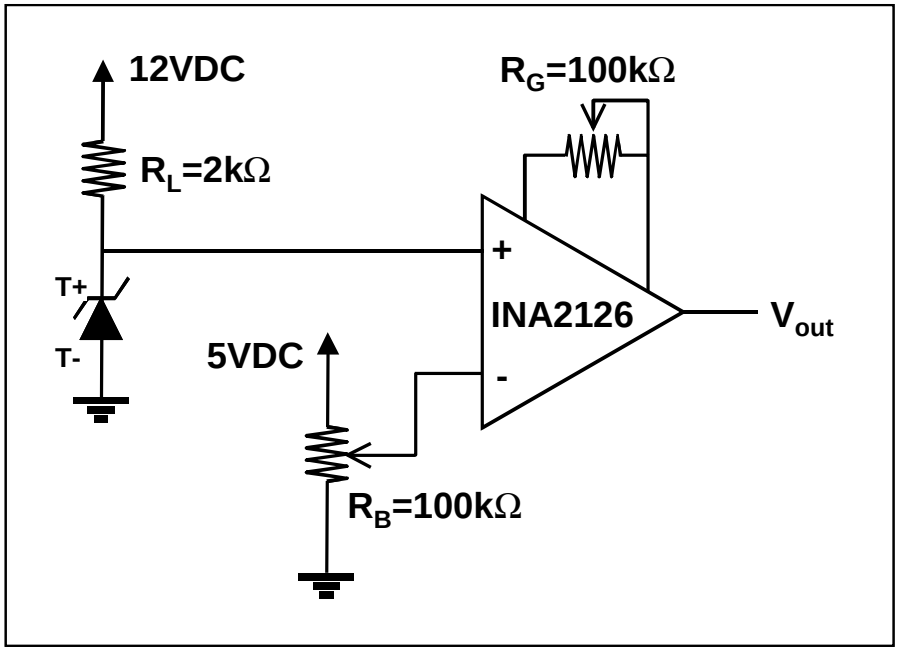

Figure 2. Temperature sensor excitation circuit

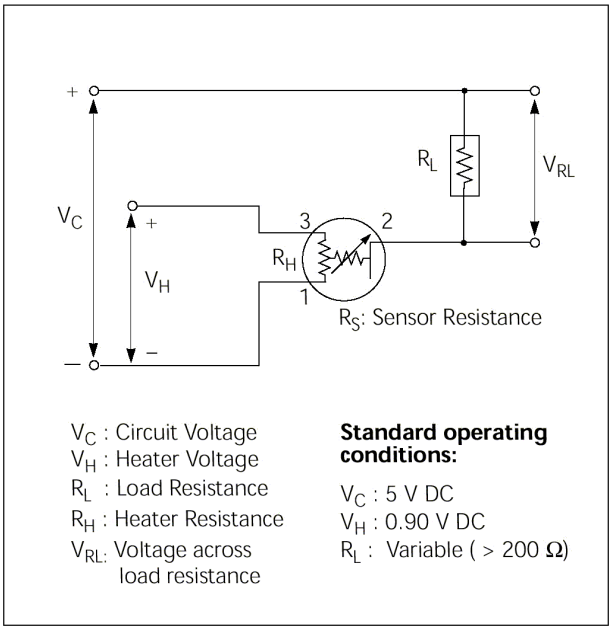

Figure 3. Gas sensor excitation circuit (from FIS)