HCH-1000 Series Humidity Sensor Calibration and Output Circuit Data

Honeywell

Frequency Output Circuit

- **This circuit is a typical frequency output circuit using the timer 555.**
- **The HCH-1000, used as variable capacitor, is connected to the THRES and TRIG pin. Rv is a variable resistor which compensate an output frequency about the basic capacitance value of HCH-1000. Since the charge and discharge of the sensor run through different resistors, R1 and (Rv+R2), the duty cycle is determined by:**

$$T(high) = C@\%RH \times [R_1 + (Rv + R_2)] \times \ln 2$$

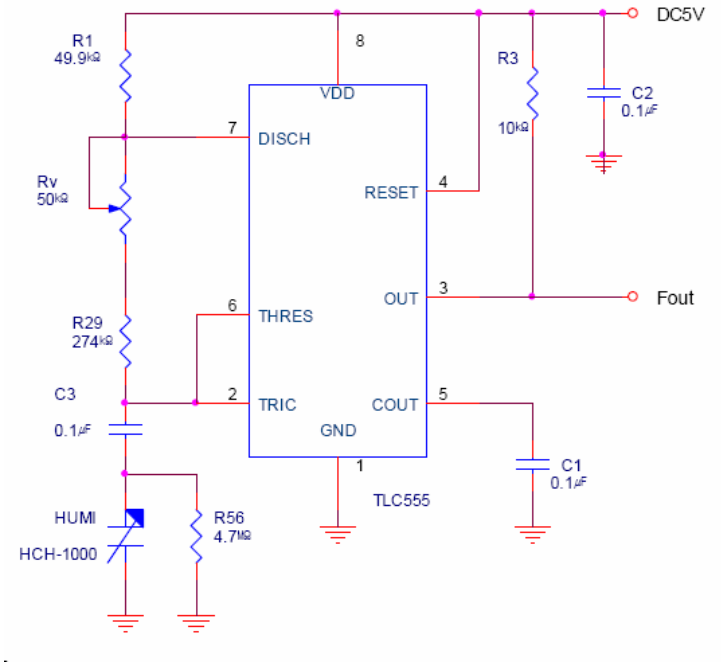
$$T(low) = C@\%RH \times (Rv + R_2) \times \ln 2$$

$$Period = T(high) + T(low) = C@\%RH \times [R_1 + 2 \times (Rv + R_2)] \times \ln 2$$

$$F = \frac{1}{Period} = \frac{1}{C@\%RH \times [R_1 + 2 \times (Rv + R_2)] \times \ln 2}$$

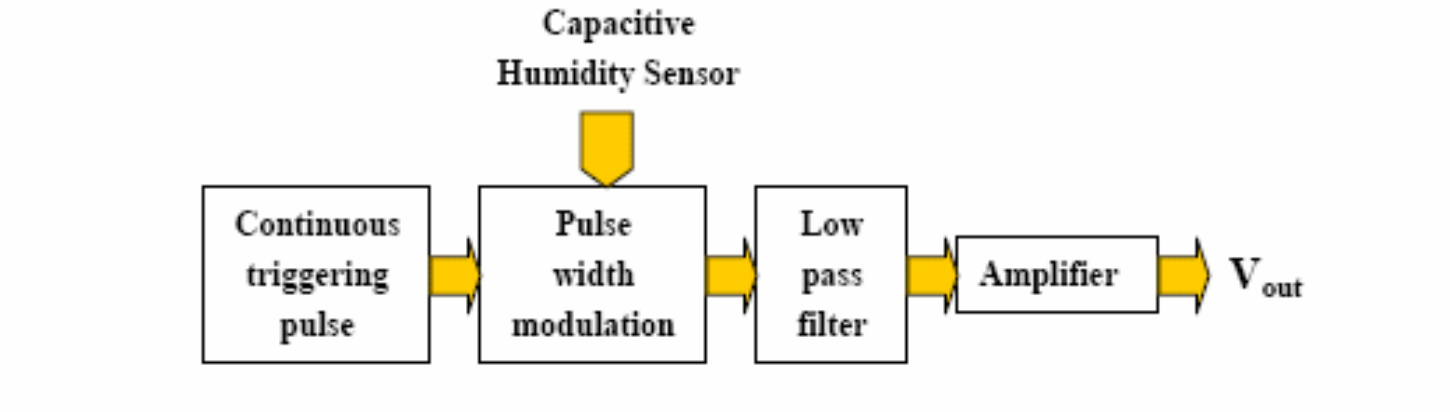
$$Output\ duty\ cycle = T(high) \times F = \frac{R_1 + (Rv + R_2)}{R_1 + 2(Rv + R_2)} \times 100\ \%$$

- **The external capacitor charges through R1+(Rv+R2) and discharges through (Rv+R2). Thus, the duty cycle may be precisely set by the ratio of these two resistors if the duty cycle is close to 50%. Therefore, the frequency is independent of the supply voltage.**



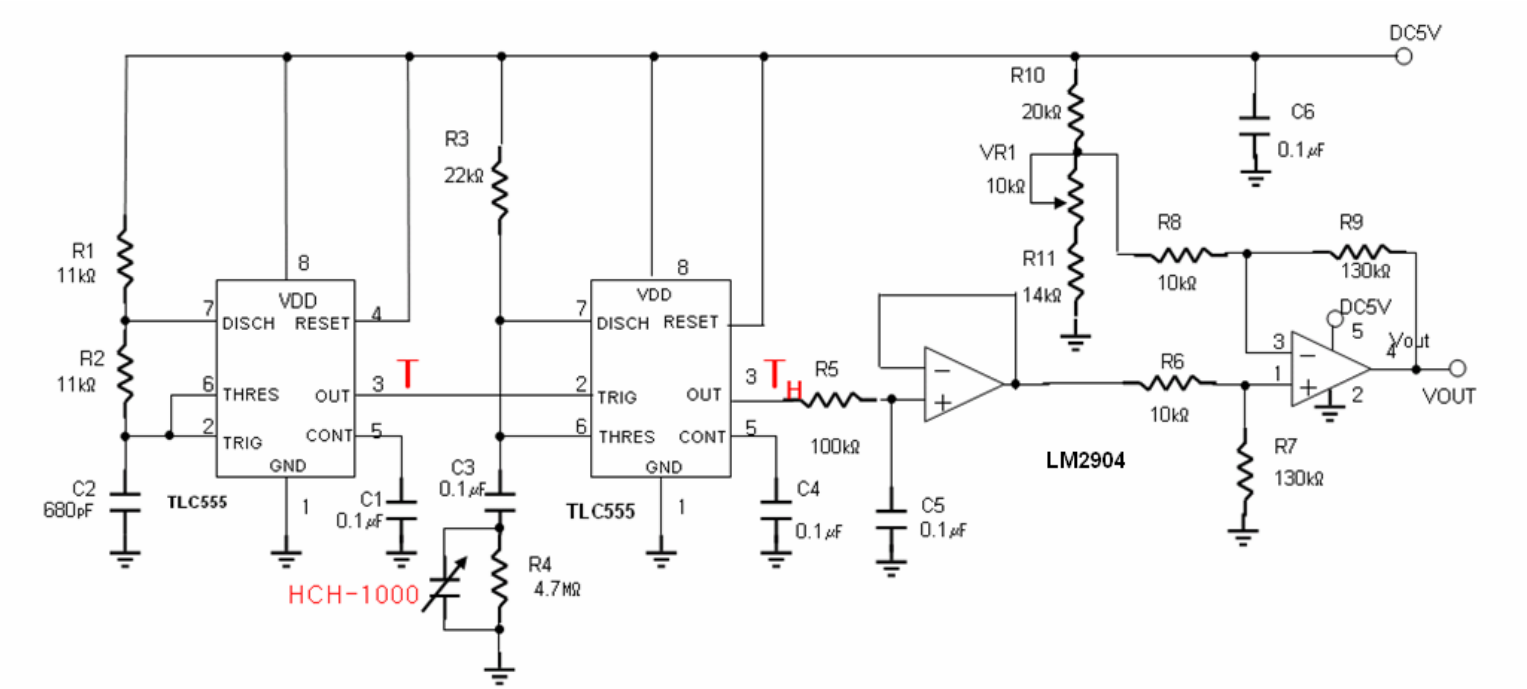
Voltage Output Circuit

- Block diagram
  - This is a dc voltage output model using the timer IC 555. The output of the sensor is a dc voltage linked to the capacitive humidity sensor. The circuit built operates in pulse width modulation (PWM) mode, which is one of the functions of timer IC 555.



- This sensor support electronic circuitry uses two timers. One timer continuously issues a pulse train in order to trigger the other timer, which operates in PWM mode.

Voltage Output Circuit – One-Point Calibration



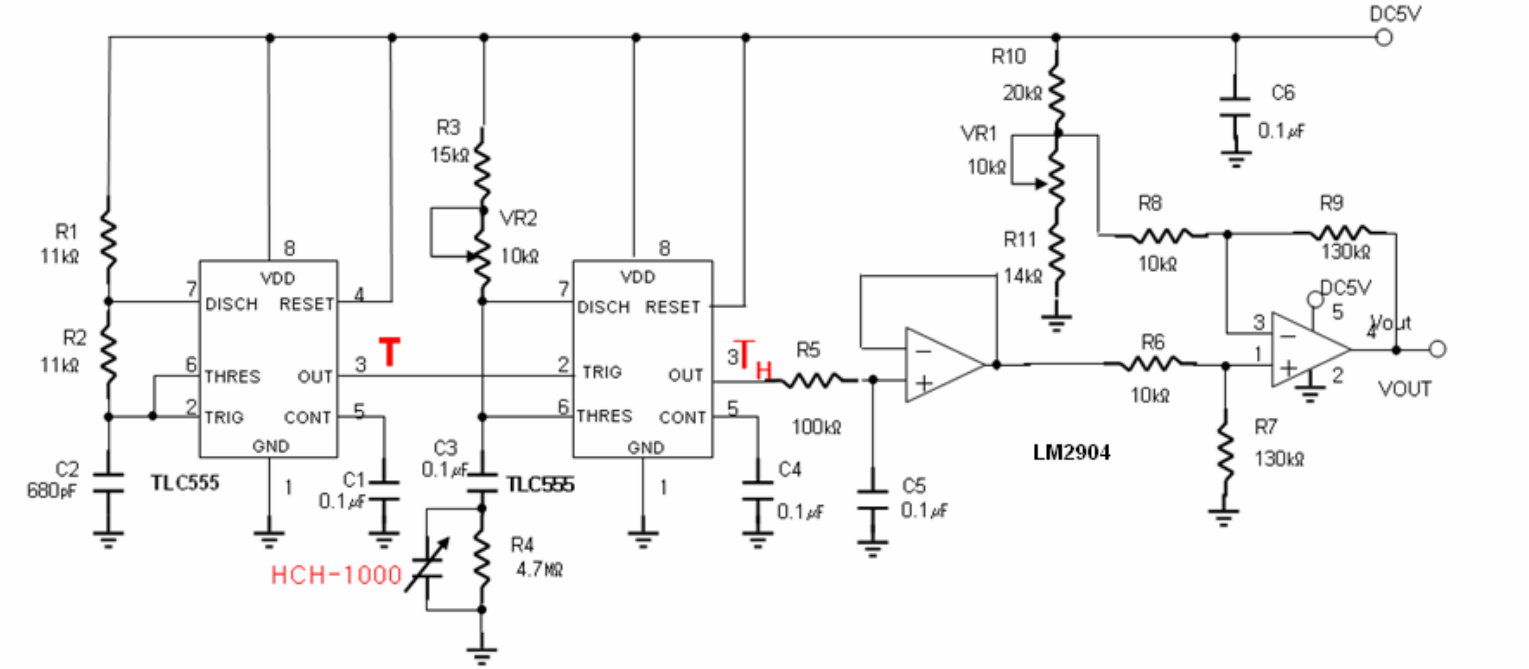
- **Fout = 1.44 / {(R1+2*R2)*C2}**
- **T= 1 / Fout**
- **TH = 1.1 * R3 * C(HCH-1000)**
- **Note: T > TH (at 0 %RH to 100 %RH)**

Voltage Output Circuit – One-Point Calibration

1. Put a product equipped with HCH-1000 into a standard chamber or a humidity generator (25 °C, 60 %RH).
2. Supply +5 V with a dc power supply.
3. Connect Vout of the module with (+) terminal of digital multi-meter and GND of the module with (-) terminal of digital multi-meter, respectively.
4. Adjust the value of a multi-meter with a variable resistor (VRI) in order to correspond with the value of specification.
5. Fix variable resistor (VRI) with a lock-tight after adjusting its value so as not to change a set value by external force.
6. In case of using a saturated solution, please put a module of HCH-1000 into NaBr [generator (25 °C, 57.57 %RH)] and adjust the resistor value.

- Notes:
  - One-point calibration has a limitation in that the characteristics of voltage output is dependent upon the characteristics of sensitivity of HCH-1000. It is a suitable calibration method for the product's accuracy required up to ± 3 %RH.
  - For products requiring a higher accuracy, two-point calibration is recommended.

Voltage Output Circuit – Two-Points Calibration

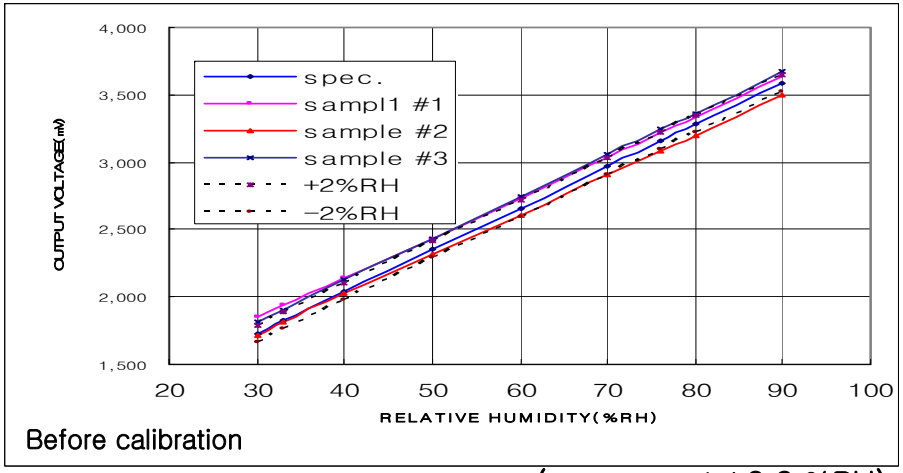


- **Fout = 1.44 / {(R1+2*R2)*C2}**
- **T= 1 / Fout**
- **TH = 1.1 * (R3+VR2) * C(HCH-1000)**
- **Note: T > TH (at 0 to 100 %RH)**

Voltage Output Circuit – Two-Points Calibration

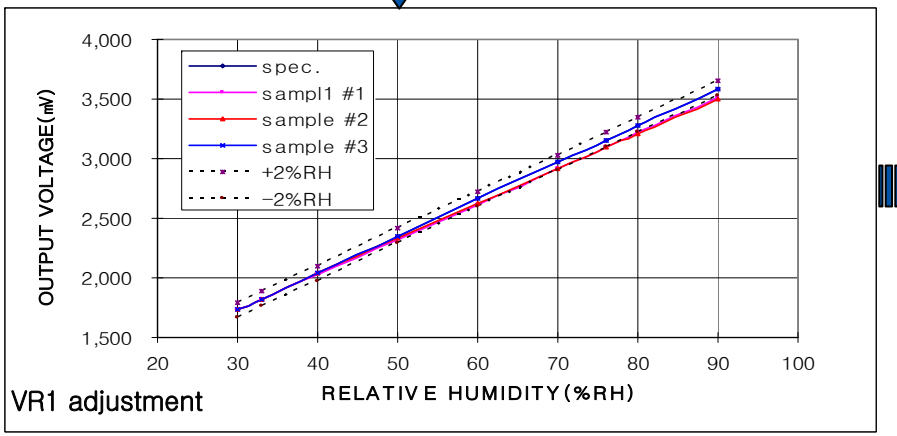
1. Put a product equipped with HCH-1000 into a standard chamber or a humidity generator @ 25 °C, 11 %RH or 33 %RH.
2. Supply +5 V with a dc power supply.
3. Connect Vout of the module with (+) terminal of digital multi-meter and GND of the module with (-) terminal of digital multi-meter, respectively.
4. Adjust the value of a multi-meter with a variable resistor VR1 in order to correspond with the value of specification. (Offset control)
5. Put a product equipped with HCH-1000 into a standard chamber or a humidity generator @ 25 °C, 76 %RH.
6. Adjust the value of a multi-meter with a variable resistor VR2 in order to correspond with the value of specification. (Span control)
7. Repeat item 4 and item 6 as remarked above in order to correspond with the value of specification.
8. Fix variable resistor (VR2) with a lock-tight after adjusting its value so as not to change a set value by external force.
9. In case of using a saturated solution, please put a module of HCH-1000 into NaCl [generator (25 °C, 75.3 %RH)] and adjust the resistor value.

With Adjustments



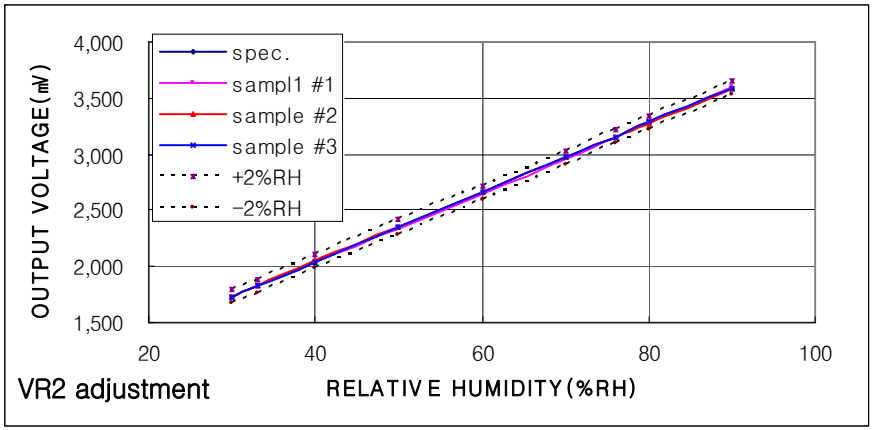
Before calibration

(accuracy < ±3.9 %RH)



VR1 adjustment

(accuracy < +0.1/−2.7 %RH)



VR2 adjustment

(accuracy < ±0.5 %RH)