



# 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:

$$T(\text{high}) = C @ \% RH \times [R_1 + (R_v + R_2)] \times \ln 2$$

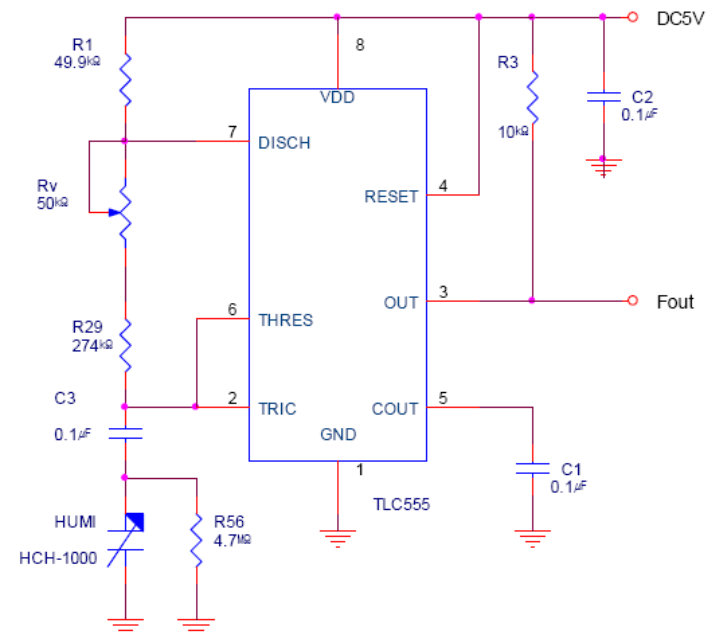
$$T(\text{low}) = C @ \% RH \times (R_v + R_2) \times \ln 2$$

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

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

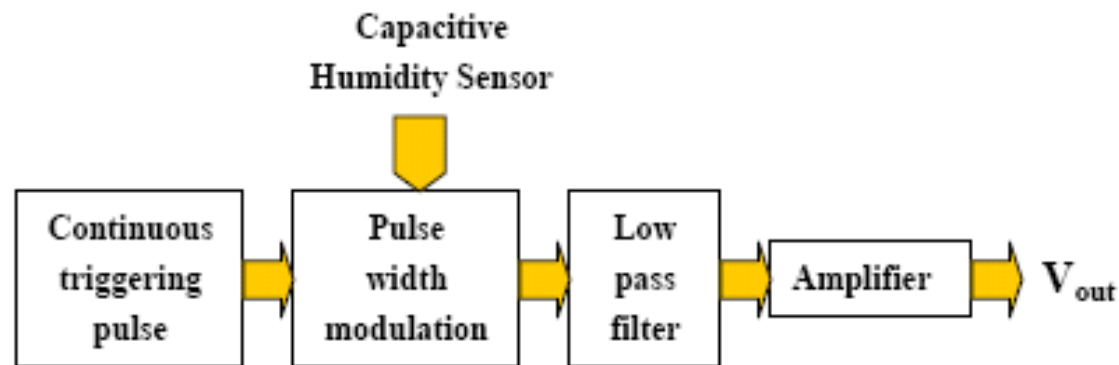
$$\text{Output duty cycle} = T(\text{high}) \times F = \frac{R_1 + (R_v + R_2)}{R_1 + 2(R_v + R_2)} \times 100 \%$$

- 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.



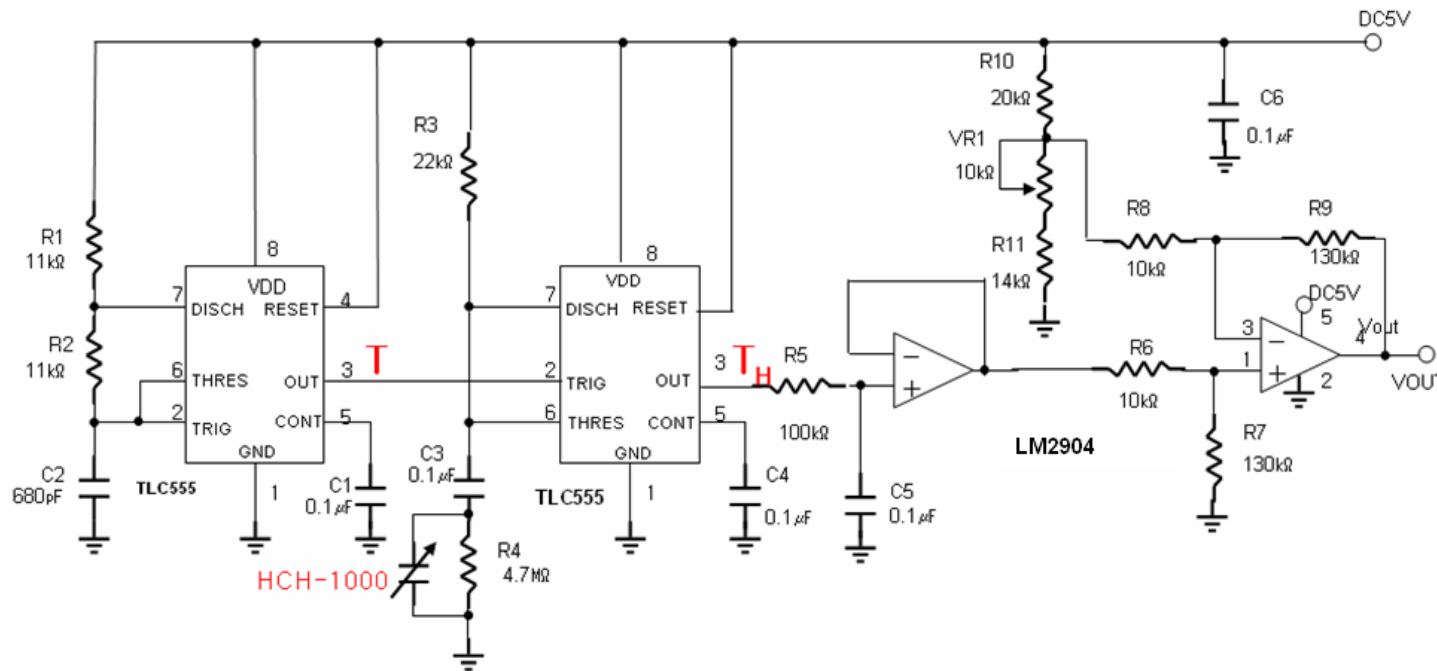
# Voltage Output Circuit

- 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

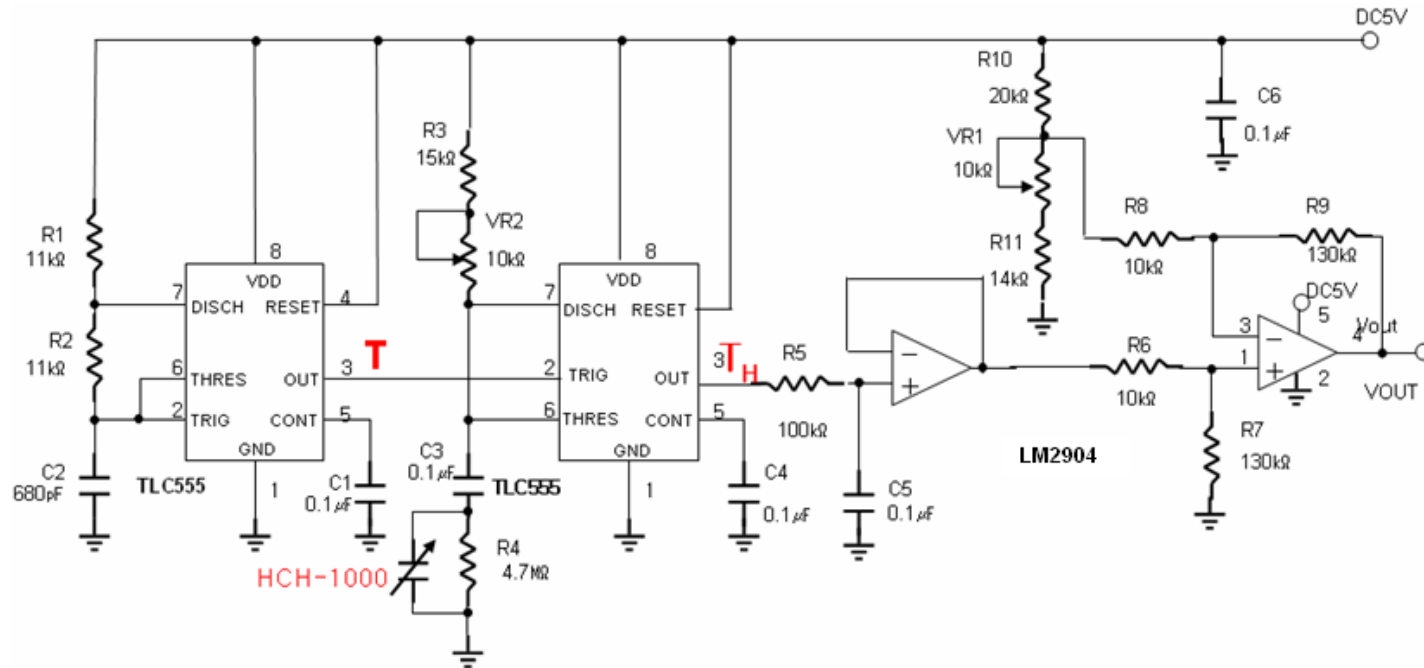


- $F_{out} = 1.44 / \{(R1+2*R2)*C2\}$
- $T = 1 / F_{out}$
- $TH = 1.1 * R3 * C(HCH-1000)$
- **Note:  $T > TH$  (at 0 %RH to 100 %RH)**

## 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  $\pm 3$  %RH.
    - For products requiring a higher accuracy, two-point calibration is recommended.

## Voltage Output Circuit – Two-Points Calibration

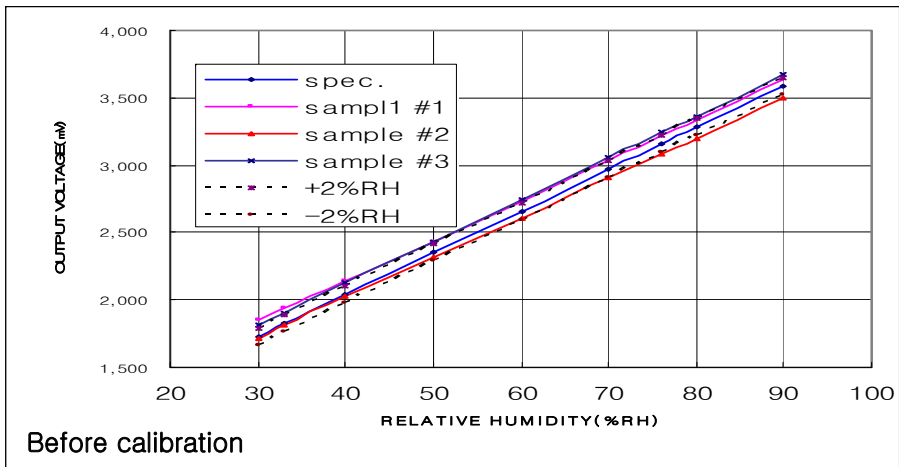


- $F_{out} = 1.44 / \{(R1+2*R2)*C2\}$
- $T = 1 / F_{out}$
- $TH = 1.1 * (R3+VR2) * C(HCH-1000)$
- **Note:  $T > TH$  (at 0 to 100 %RH)**

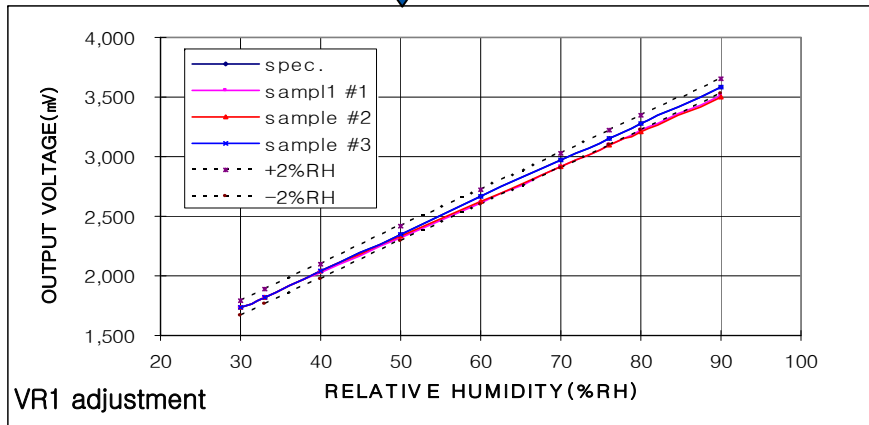
# Voltage Output Circuit – Two-Points Calibration

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.

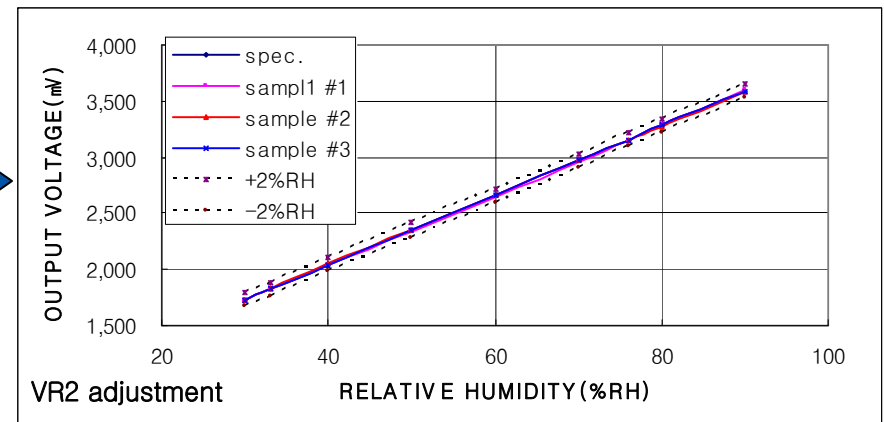
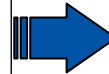
## With Adjustments



(accuracy <  $\pm 3.9$  %RH)



(accuracy <  $+0.1/-2.7$  %RH)



(accuracy <  $\pm 0.5$  %RH)





## **HCH-1000 Humidity Products – Warranties and Remedies**

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## Warranties and Remedies

### **WARNING**

#### **PERSONAL INJURY**

DO NOT USE these products as safety or emergency stop devices or in any other application where failure of the product could result in personal injury.

**Failure to comply with these instructions could result in death or serious injury.**

### **WARNING**

#### **MISUSE OF DOCUMENTATION**

- The information presented in this product sheet is for reference only. Do not use this document as a product installation guide.
- Complete installation, operation, and maintenance information is provided in the instructions supplied with each product.

**Failure to comply with these instructions could result in death or serious injury.**

### **WARRANTY/REMEDY**

Honeywell warrants goods of its manufacture as being free of defective materials and faulty workmanship. Honeywell's standard product warranty applies unless agreed to otherwise by Honeywell in writing; please refer to your order acknowledgement or consult your local sales office for specific warranty details. If warranted goods are returned to Honeywell during the period of coverage, Honeywell will repair or replace, at its option, without charge those items it finds defective. **The foregoing is buyer's sole remedy and is in lieu of all other warranties, expressed or implied, including those of merchantability and fitness for a particular purpose. In no event shall Honeywell be liable for consequential, special, or indirect damages.**

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