HS1101 Relative Humidity Sensor (#27920)

The HS1101 humidity sensor is a cost-effective solution for measuring relative humidity within ±5% accuracy. The sensor's design is based on a unique capacitive cell; therefore, by using simple RC circuit wiring it is easy to interface with any Parallax microcontroller, including the BASIC Stamp® and Propeller chip.

Features

- Simple calibration required when operating in standard conditions
- Fast response time
- Simple, RCTIME output corresponds to relative humidity when directly connected to BASIC Stamp
- Compatible with automatized assembly processes, including wave soldering, reflow and water immersion
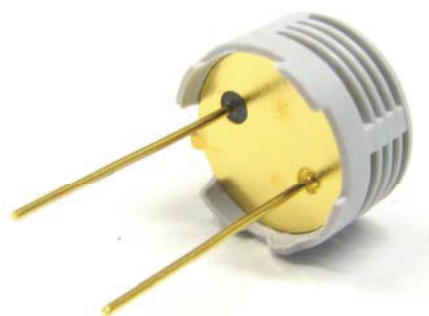
Key Specifications

- Power requirements: 5 to 10 VDC
- Communication: Analog output of varying capacitance in response to change in relative humidity
- Humidity Measuring Range: 1 to 99% RH
- Operating temperature: -40 to 212 °F (-40 to 100 °C)

Application Ideas

- Home and office automation
- Humidity component for weather station applications
- Industrial process control systems

Specifications

Symbol	Quantity	Minimum	Typical	Maximum	Units
Vs	Supply Voltage †		5.0	10	V
RH	Measuring Range †	1		99	%
Ta	Operating Temperature †	-40		100	°C
Tcc	Temperature Coefficient		0.23		$T_{Decay}/°C$
ta	Response time (33 – 76 % RH) †		5		S

† Information obtained from the Humirel HS1101 Manufacturer Datasheet Rev 7.

Connecting and Testing

Connecting the HS1101 to a microcontroller is demonstrated here with a BASIC Stamp module. It is a straightforward application, requiring only one I/O pin. Since the HS 1101 is based on a unique capacitive cell, relative humidity can be obtained using a simple RC wiring diagram, as shown in Figure 1.
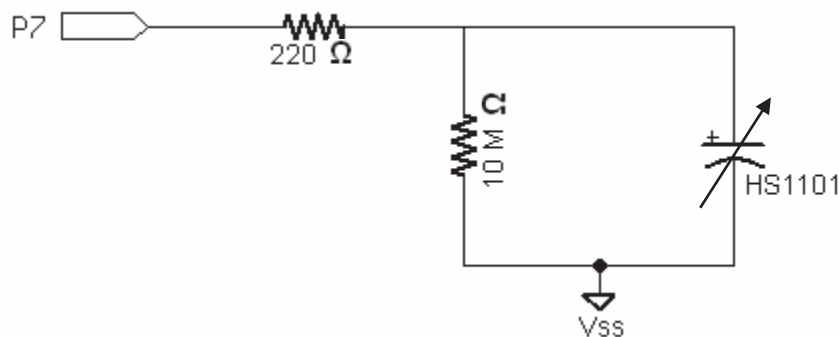
Figure 1: Sample RC Application Circuit

BASIC Stamp 2 Series Example

Below are the steps required to obtain relative humidity readings from the HS1101:

√ Build the circuit shown in Figure 1. Be sure the negative side of the sensor is connected to ground as shown in Figure 2!
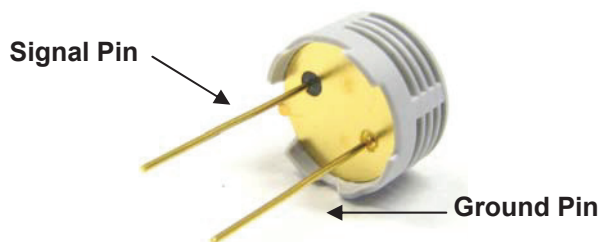
Figure 2: Signal and Ground Pins

√ Enter and run the test program RelativeHumidityReading.bs2 included in the source code section on page 4. All of the source code is also available from the Downloads section of the HS1101 Relative Humidity Sensor product page at www.parallax.com.
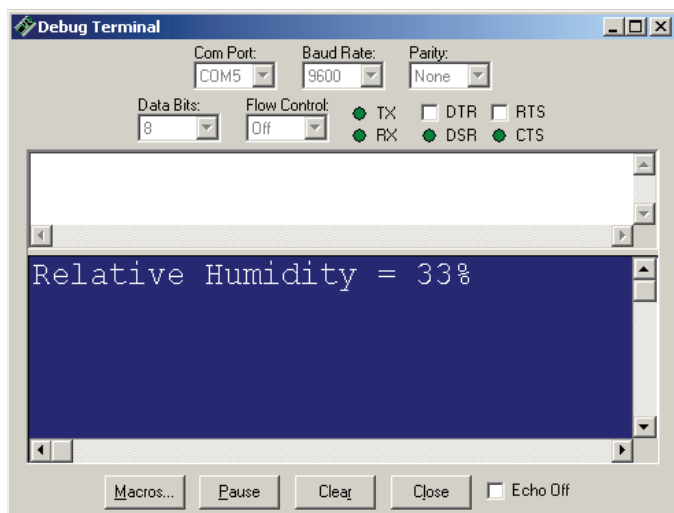√ You should obtain results similar to those shown in Figure 3.

Figure 3: Typical Debug Output

Device Information

Linear approximation was used to obtain relative humidity readings for this application. Therefore, the results can have up to a ±5% RH error. In addition, when operating in temperatures 25° higher or lower than room temperature, the RH error can increase by ±2%. If more precise results are desired, additional calibration is required.

The linear approximation constant used to determine relative humidity can vary if operating in different environments. For more precise measurements, use a known humidity meter and adjust the RHconstant value in RelativeHumidityReading.bs2 until the Debug Terminal output matches the known humidity reading.

Since the HS1101 relative humidity sensor is based on a capacitive cell, relative humidity can be related to the decay time of the sensor. Using several measurements taken in a humidity controlled environment, a simple line equation can be calculated using linear approximation to define the relationship between the decay time of the sensor and the percent of relative humidity:

$$T_{Decay} = 2.4 \bullet \%RH + RHconstant$$

Using this equation, a typical response curve can be derived when applying this equation to different percents of relative humidity.

Typical Response Curve for RCTIME Application
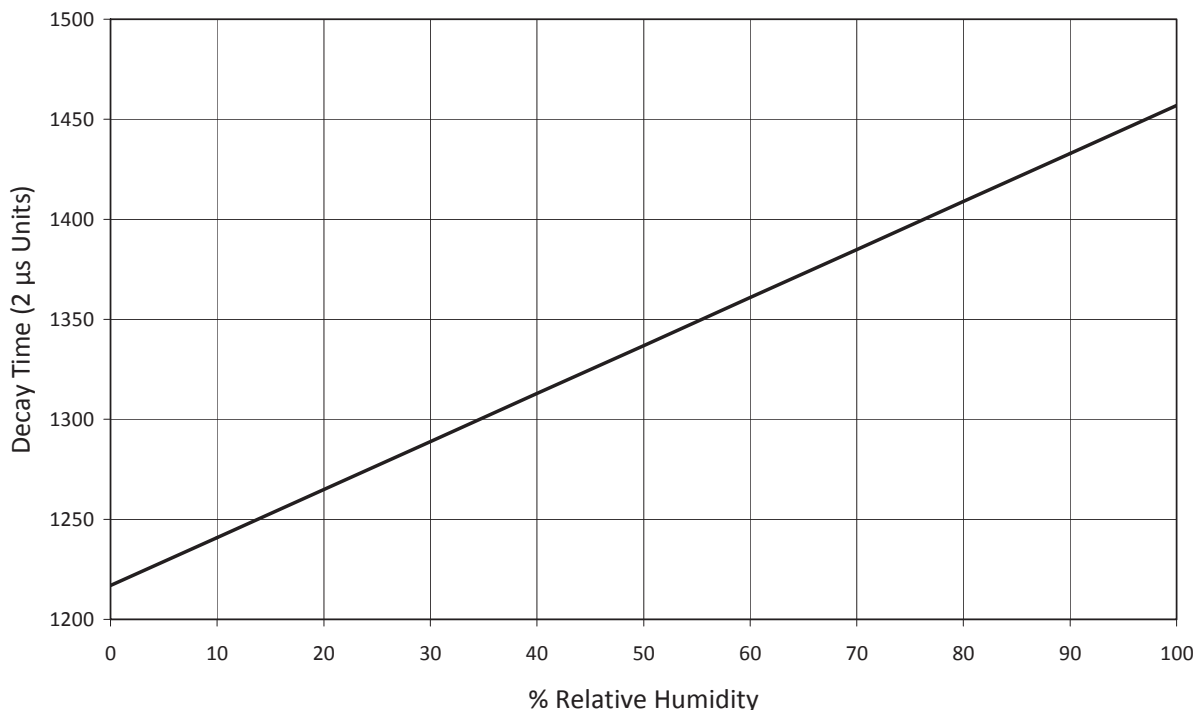
Example Source Code

While this sensor is compatible with all Parallax microcontrollers, the included source code is solely for BASIC Stamp® 2 microcontroller. When working with other BASIC Stamp models, a scale factor will have

to be applied to your code to account for different clock speeds. (For more information see the `RCTIME` command in the BASIC Stamp Syntax and Reference Manual.)

Additional calculations and coding techniques will be required when interfacing with any other Parallax microcontroller, since `RCTIME` is specific to the PBASIC programming language for BASIC Stamp microcontroller modules.

Additional Spin programs have been developed to measure decay time and capacitance with the Propeller chip. Use these programs in conjunction with performing additional control tests to develop Propeller applications. Go to *forums.parallax.com -> Propeller Chip -> Propeller Education Kit Labs* for more information.

BASIC Stamp® 2 Program

```
' {$STAMP BS2}
' {$PBASIC 2.5}
' RelativeHumidityReading.bs2
' Displays relative humidity in the Debug Terminal or the Parallax Serial LCD.

LCD             PIN     0                   ' Serial output to LCD

time            VAR     Word
humidity        VAR     Word

LcdBaud         CON     84                  ' Baud rate of LCD
RHconstant      CON     12169               ' Relative Humidity Constant * 10

LcdCls          CON     $0C                 ' Clear LCD (use PAUSE 5 after)
LcdCR           CON     $0D                 ' Move pos 0 of next line
LcdBLon         CON     $11                 ' Backlight on
LcdBLoff        CON     $12                 ' Backlight off
LcdOff          CON     $15                 ' LCD off
LcdOn1          CON     $16                 ' LCD on; cursor off, blink off
LcdLine1        CON     $80                 ' Move to line 0, position 0
LcdLine2        CON     $9A                 ' Move to line 1, position 5

HIGH Lcd                                    ' Setup serial output pin
PAUSE 100

SEROUT Lcd, LcdBaud, [LcdOn1]               ' Initialize LCD
PAUSE 250
SEROUT Lcd, LcdBaud, [LcdBLon]              ' Turn Backlight on
PAUSE 5
SEROUT Lcd, LcdBaud, [LcdCls]               ' Clear LCD
PAUSE 5

DO
  HIGH 7
  PAUSE 1
  RCTIME 7, 1, time
  time = time * 10
  humidity = (time - RHconstant) / 24

  ' Debug Display:
  DEBUG HOME, "Relative Humidity = ", DEC humidity, "%"

  ' LCD Display:
  SEROUT Lcd, LcdBaud, [LcdLine1, "RelativeHumidity",
                        LcdLine2, DEC humidity, "%" ]
  PAUSE 100
LOOP
```