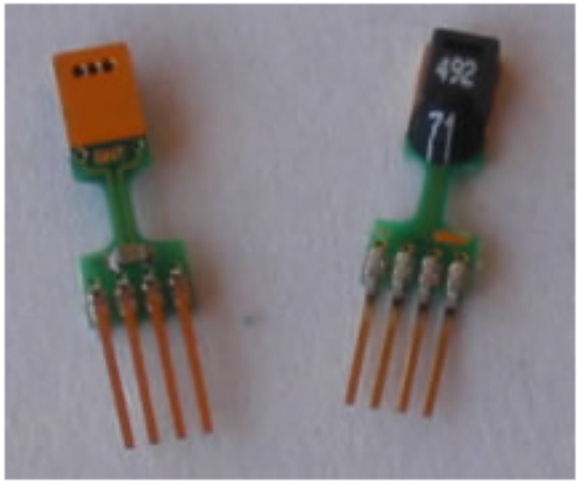
SHT75PG

Humidity and temperature sensor mounted in PG7 gland for sealing to enclosure or probe body.

SHT75

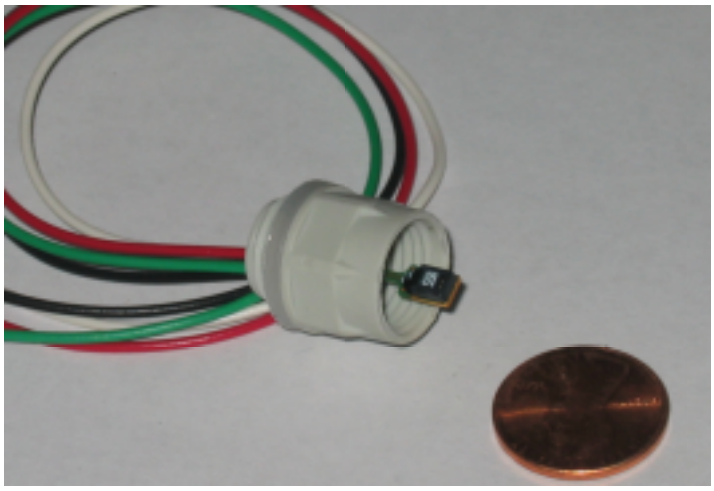
The Sensirion humidity/temperature sensor (http://www.sensirion.com) is a single integrated sensor chip that produces fully calibrated digital output with Swiss precision. A microcontroller, such as the BASIC Stamp™, reads out the values via its two-wire digital serial interface, and then applies a little math to achieve ±2% humidity accuracy and ±0.5% Celsius temperature accuracy. EME Systems sells only the highest accuracy grades of the Sensirion sensor.



In particular, the SHT75 comes in a SIP package that features a long neck for low thermal mass, a flow-through air path for fast response, and pins on 0.05" centers. We also stock the SHT15, the surface mount version of this IC (described on page 7).

SHT75PG

In order to apply this sensor in weather stations or other harsh environments it is necessary to provide mechanical mounting for the delicate structure, protection for the wiring, and also in some instances a membrane over the sensor that will exclude spray and other pollutants but allow for transfer of water vapor. The SHT75PG from EME Systems provides these functions.



In the SHT75PG, we mount the sensor in a PG7 gland nut, sealed at the back with 4 color coded wires, and we incorporate the necessary resistors and the capacitor shown in the schematic on the next page. This arrangement can allow for sealing to an enclosure, and still maintain low thermal mass and good air flow. A cover and membrane can be installed as shown on the following pages to improve the protection.

The SHT75PG here is mounted on a sealed polycarbonate enclosure. The sensor element itself is protected under a membrane permeable to water vapor. The enclosure can be drilled 7/16" and tapped PG7, or the enclosure can be drilled 1/2" and a PG7 nut (included) installed on the inside. Inside the enclosure can be a data logger or transition wiring to a cable.

The SHT75PG above is mounted on a length of 3/8" PVC pipe, drilled 7/16" at both ends and tapped PG7. Connection is made to a cable. This unit is shown with the protective cap removed for fastest response. A level of protection appropriate to the environment can be installed. Observe that the open PG7 guards the sensor from breakage, but allows for good air flow.

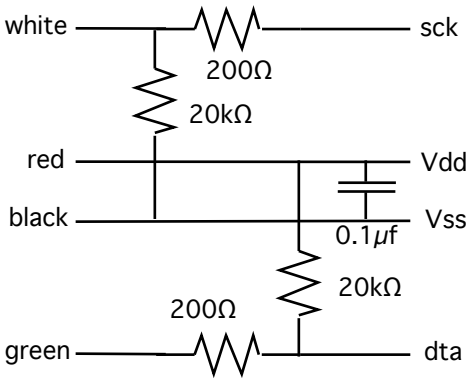
Schematic diagram and connections. The SHT75PG includes the resistors and the bypass capacitor that are necessary for application of the Sensirion sensor. There is a pullup resistor on the data (dta) line, a pull-down resistor on the clock (sck) line, and small resistors protect the chip from mis-wiring and static discharge.

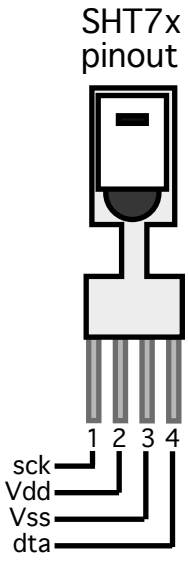
White or yellow wire is clock signal from microprocessor.

Red wire to +5 volts.

Black wire to common.

Green wire is data signal to and from the microprocessor.

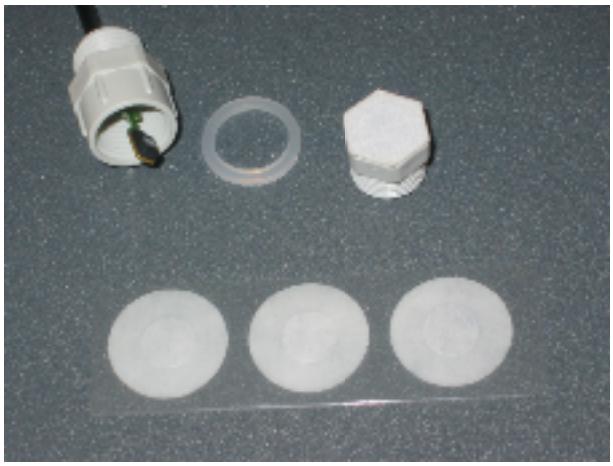


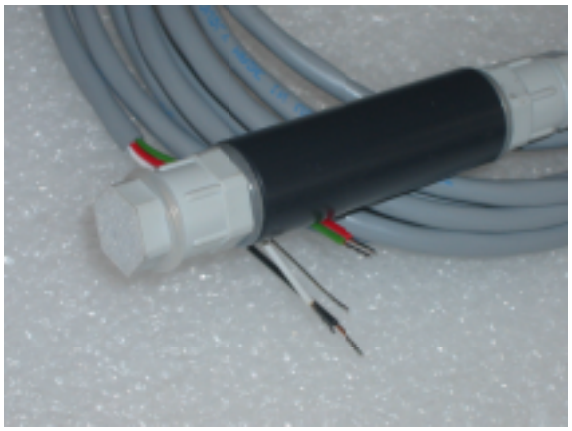


It is possible to operate the sensor uncapped, which gives the fastest response. However protection from splashed water and from pollutants is afforded by a Gore protective vent, a membrane permeable to water vapor but not to liquid water or particles. The assembly with the membrane should still be protected so that pollutants, including oil, do not accumulate.

Spare vents are available from EME Systems.

The Gore protective vent should be replaced periodically or when it becomes dirty. It comes on a circle of material with a strong acrylic adhesive on one side.. To replace the membrane, remove the old one and clean the rim of the funnel shaped opening of the cap. Remove the new vent from the carrier strip and place it adhesive side up on a smooth surface. Center the cap over the vent and press down firmly. Allow the adhesive to cure overnight. Using a sharp razor, trim the edges of the vent. Replace the cap and sealing washer onto the sensor.





Specifications SHT75PG

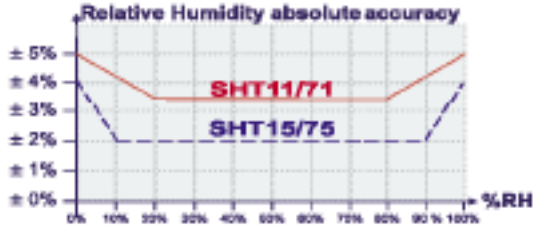
Humidity

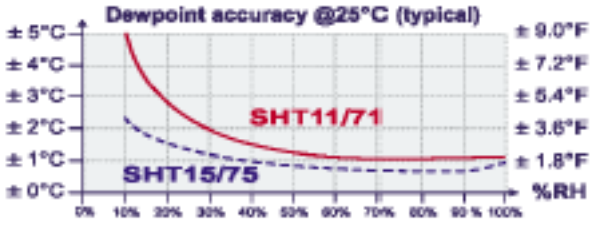
resolution 0.03% RH
repeatability ±0.1% RH
accuracy & interchangeability ±2% RH (over range of 10% to 90% RH)
nonlinearity <1% RH (after linearity compensation math)
range 0%–100% RH
response time 4 seconds (slowly moving air, no cap) to within 67% of final
hysteresis ±1% RH
long term stability < 1% RH per year typical

Temperature

resolution ±0.01 °C
repeatability ±0.1 °C
accuracy ±0.5 °C from 0°C to 40°C, <1°C from -20°C to +65°C
range -40 to +123 °C
response time 5 to 30 seconds to within 67% of final value

for additional specifications, and applications notes, please download the SHT1x/SHT7x data sheet from
http://www.sensirion.com, and visit http://www.emesystems.com/RHTPG75.htm



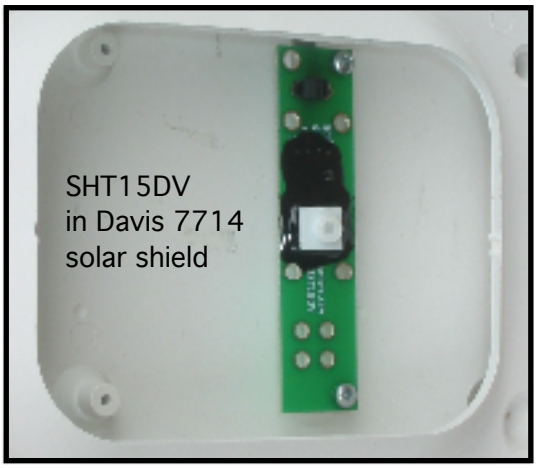


Demo program. The following is a demo program for the BASIC Stamp II. It reads both the humidity and temperature from the SHT75 (or any of the chips in this line), and does the math to maintain the best resolution and to provide the temperature compensation. As usual with the serial interface chips, it is necessary to read the data sheet carefully to understand the serial protocol. The chip uses a protocol similar to I2C, but different. (You cannot use the BS2P I2C commands.) There is a start sequence and also an acknowledge after each byte, for the rest it uses SHIFTIN and SHIFTOUT commands.

```
' SHT75.bs2 version C
‘ (c) 2002, 2004 Tracy Allen, http://www.emesystems.com
‘ See web site for additional programs and app notes.
‘ {$STAMP BS2}
‘ {$PBASIC 2.5}
' access the Sensirion model SHT75, SHT15, SHT71, SHT11
‘ humidity and temperature chip
' temperature to xx.x degrees Celsius, RH to xx.x %
‘ Repeatedly shows raw data and converted values on debug screen.
‘ This program uses Stamp pins p0 for data and p1 for clock.
' hookup sht11 or sht15 as follows for this program
‘
' STAMP                       SENSIRION
‘ colors refer to RHTPG75 wire color code
‘                     200
' white p1 ----o-----/\/\---o--  sck, clock
‘                           |
'              ;---/\/\-----‘ pull-down
'              |   20k
‘ black Vss--o-o---------------  common
'            |
‘           ===  0.1uf
'            |
‘ red   Vdd--o-o---------------  +5 volts
'              |    20k
‘              '---/\/\-----; pull-up
‘                           |
'                     200   |
‘ green p0 ----------/\/\---o--  dta, data
'


sck PIN 1 ‘ note, 20k pull-down, also 200ohm in series for protection
dta PIN 0 ‘ note, 20k pull-up, also 200ohm in series for protection

‘ the following are Sensirion command bytes
shtTR CON 3 ' read temperature
shtRH CON 5 ‘ read humidity
shtSW CON 6 ' status register write
shtSR CON 7 ‘ status register read
shtS0 CON 30 ' restore status register defaults (be sure to delay 11 milliseconds)

cmd     VAR Byte  ‘ will hold command byte sent to Sensirion
result  VAR Word ‘ raw result from sht, also used as counter
r0      VAR result.byte0
r1      VAR result.byte1
degC    VAR Word ' degrees Celsius * 100
RH       VAR Word ‘ %RH * 10
RHtc     VAR Word ' for temperature compensation of RH
```

```
initialize:
 outs=0
 dirs=%1111111111111110   ‘ p0 input for data, p1 output for clock

 GOSUB shtrst ‘ reset communication with sht

DO
 getTemperature:
 cmd=shtTR ’ temperature command to sht
 GOSUB shtget16
 degC=result+5/10-400 ‘ from 100ths to 10ths of a degree with rounding
 DEBUG CR,“degC=”,REP “-”\degC.bit15,DEC ABS degC/10,“.”,DEC1 ABS degC
 getHumidity:
 cmd=shtRH ’ humidity command to sht
 GOSUB shtget16
 RH=(26542-(54722**result+result))**result-40
 ‘ temperature compensation follows:
 RHtc=655+(result*5)+(result**15917) ’ intermediate factor
 RHtc=(RHtc**(degC+2480))-(RHtc**2730)+RH ‘ compensated value
 ‘DEBUG tab, “raw=”,DEC result,tab,“%RH=”,DEC RH/10,“.”,DEC1 RH ‘show uncompensated RH
 DEBUG tab,“%RH=”,DEC RHtc/10,“.”,DEC1 RHtc     ‘ final compensated RH
 NAP 7   ‘ sleep for 2 seconds, then do it again
LOOP

’ initializes communication with sht
shtRst:
 SHIFTOUT dta,sck,lsbfirst,[$ffff\16]
RETURN

‘ get 16 bits of data, enter with command in “cmd”
shtget16:
 gosub shtcmd ’ send the command “cmd”
 gosub shtwait ‘ wait for command to finish
 shiftin dta,sck,msbpre,[r1] ’ msbyte
 low dta ‘ acknowledge
 pulsout sck,10
 input dta
 shiftin dta,sck,msbpre,[r0] ’ lsbyte
 input dta ‘ terminate communication
 pulsout sck,10
return

’ send start sequence and command
shtcmd:
shtStart: ‘ send the start sequence
 ’ dta: ~~~~~|_____|~~~~~~
 ‘ sck: ___|~~~|_|~~~~|____
 ’ while dta is low, clock goes low and then high
 input dta ‘ pullup high
 high sck
 low dta
 low sck
 high sck
 input dta
 low sck
```

```
shtcmd1: ' send the command
 shiftout dta,sck,msbfirst,[cmd]
 input dta ' allow acknowledge
 pulsout sck,10
return

shtWait:
 ' wait for sht to pull data pin low
 ' or for time out
 result=4096
 DO
 result=result-1
 LOOP WHILE dta & result.bit11
 RETURN

END
```



For additional programs and application notes, please see the emesystems web site. There is a program there to calculate the dew point, information about control of the builtin heater, and also a driver type subroutine that returns the values via a cross bank RUN command. The latter program is what we use in the EME Systems OWL2pe data logger.

Ordering from EME Systems:

SHT75PG	Sensirion probe type sensor mounted in PG7 gland, with membrane cover
SHT75PG/EPC	Mounted on polycarbonate enclosure, lefthand photo on paghe 2.
SHT75PG/P	Mounted as probe with 1 meter cable.righthand photo on page 2.
SHT75PG/M	extra membrane for cover.
SHT75	Sensirion probe type sensor, SIP with pins space 0.05", unmounted.
SHT15	Sensirion surface mount sensor.

SHT15

The surface mount version of this sensor, SHT15, is most suitable for OEM projects. An example is the air quality monitor shown below right and an installation in a Davis Instruments model 7714 radiation shield, with a white filter cap . The SHT15 when soldered to a circuit board has a larger thermal mass than the SHT75. and that is why the SHT75PG is often preferable for general environmental monitoring. The pinout of the SHT15 is different from the SHT75, but the programming is exactly the same for the two chips.