Humidity Sensor With Waterproof Connector

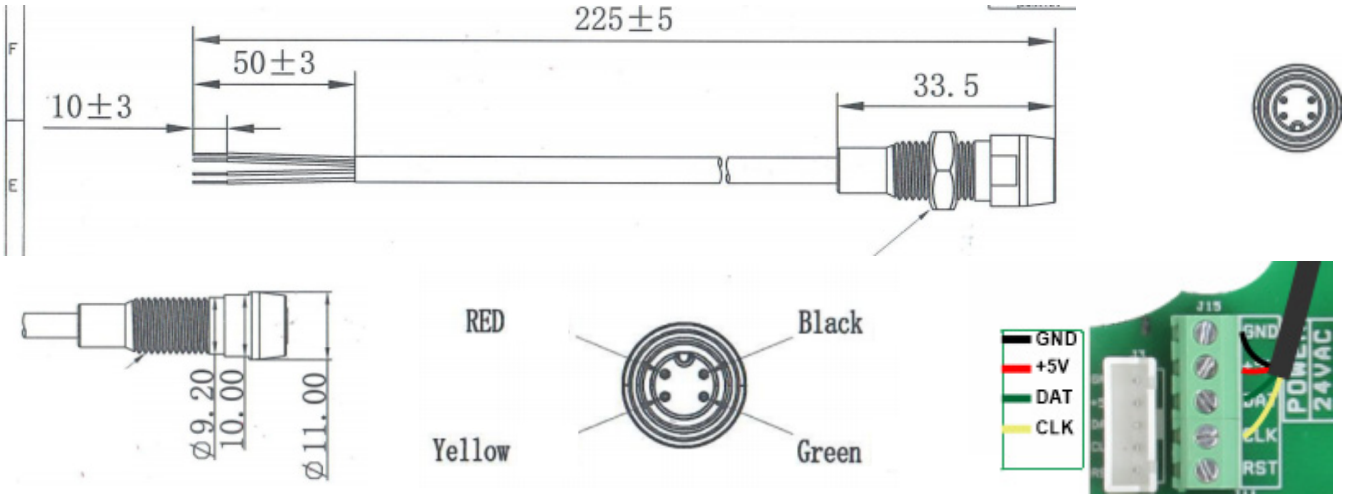
Description

This is a humidity and temperature sensor molded into a plastic housing which plugs directly into a waterproof connector, it is made for the most demanding of applications. All the way from the easy ones like pools and aquariums on up to the tougher ones like pot grow operations and outdoors in snow making equipment.

Features

- Relative humidity accuracy: up to ±1.5 %RH
- Temperature accuracy: up to ±0.1 °C
- Supply voltage: 1.08 V … 3.6 V
- Average current: 0.4 µA (at meas. rate 1 Hz)
- Idle current: 80 nA
- I2C fast mode plus, CRC checksum
- Operating range: 0…100 %RH, -40…125 °C
- Fully functional in condensing environment
- Variable power heater
- NIST traceability
- JEDEC JESD47 qualification
- Mature technology from global market leader

Dimension



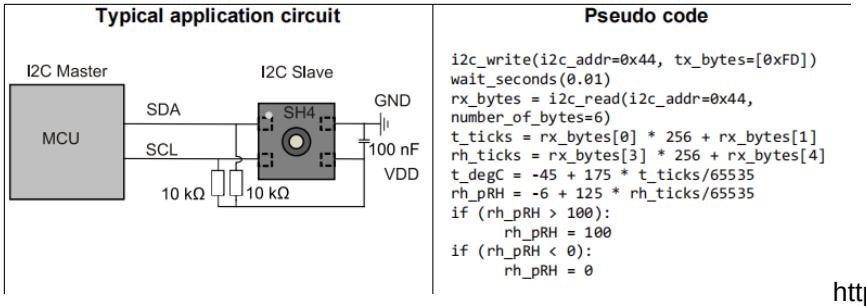
Typical Areas of Applicatins:

- Handheld measurement instruments
- Humidity transmitters
- Industrial applications
- Measuring & Sensor Technology

SHT4x is a digital sensor platform for measuring relative humidity and temperature at different accuracy classes. The I2C interface provides several preconfigured I2C addresses and maintains an ultra-low power budget. The power-trimmed internal heater can be used at three heating levels thus enabling sensor operation in demanding environments. The four-pin dual-flat-no-leads package is suitable for surface mount technology (SMT) processing.

Quick Start – Hello World

A typical application circuit for SHT4x is shown on the left-hand side of Figure 1. After reaching the minimal supply voltage and allowing for the maximal power-up time of 1 ms the sensor is ready for I2C communication. The quickest way to measure humidity and temperature is pseudo-coded on the right-hand side of Figure 1. Together with the conversion formulae given in equations (1), (2), and (3), the digital signals can be translated into relative humidity and temperature readings

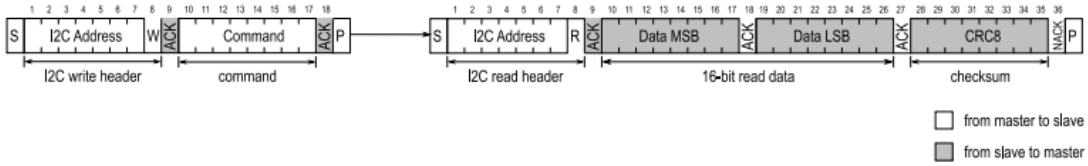


Pseudo code

```
i2c_write(i2c_addr=0x44, tx_bytes=[0xFD])
wait_seconds(0.01)
rx_bytes = i2c_read(i2c_addr=0x44,
number_of_bytes=6)
t_ticks = rx_bytes[0] * 256 + rx_bytes[1]
rh_ticks = rx_bytes[3] * 256 + rx_bytes[4]
t_degC = -45 + 175 * t_ticks/65535
rh_pRH = -6 + 125 * rh_ticks/65535
if (rh_pRH > 100):
      rh_pRH = 100
if (rh_pRH < 0):
      rh_pRH = 0
```

Typical application circuit (left) and pseudo code (right) for easy starting. For details on the signal cropping in the last four lines see section 4.5.
Find code resources and embedded drivers on: https://github.com/Sensirion/embeddedsht/releases
https://github.com/Sensirion/embedded-i2c-sht4x

I2C communication is based on NXP's I2C-bus specification and user manual UM10204, Rev.6, 4 April 2014. Supported I2C modes are standard, fast mode, and fast mode plus. Data is transferred in multiples of 16-bit words and 8-bit check sum (cyclic redundancy check = CRC). All transfers must begin with a start condition (S) and terminate with a stop condition (P). To finish a read transfer, send not acknowledge (NACK) and stop condition (P). Addressing a specific slave device is done by sending its 7-bit I2C address followed by an eighth bit, denoting the communication direction: "zero" indicates transmission to the slave, i.e. "write", a "one" indicates a "read" request



I2C transfer types: First a write header is sent to the I2C slave, followed by a command, for example "measure RH&T with highest precision". After the measurement is finished the read request directed to this I2C slave will be acknowledged and transmission of data will be started by the slave.

Data type & length

I2C bus operates with 8-bit data packages. Information from the sensor to the master has a checksum after every second 8-bit data package.
Humidity and temperature data will always be transmitted in the following way: The first value is the temperature signal (2 * 8-bit data + 8-bit CRC), the second is the humidity signal (2 * 8-bit data + 8-bit CRC).

Checksum Calculation

For read transfers each 16-bit data is followed by a checksum with the following properties

Property	Value
Name	CRC-8
Message Length	16-bit
Polynomial	0x31 ($x^8 + x^5 + x^4 + 1$)
Initialization	0xFF
Reflect Input/Output	false/false
Final XOR	0x00
Examples	CRC(0xBEEF) = 0x92

Data check sum properties
The master may abort a read transfer after the 16-bit data, if it does not require a checksum.

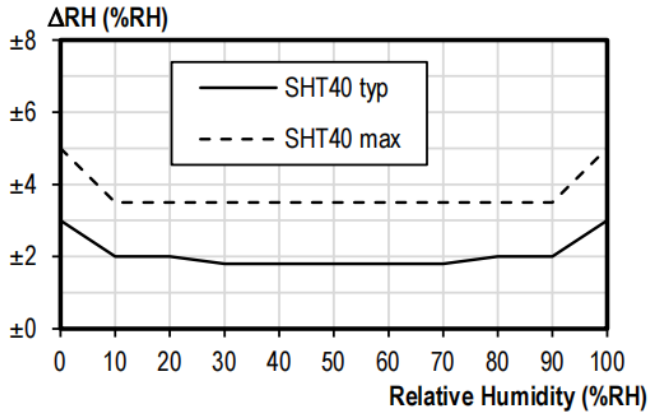
This design is the result of feedback from a decade of experience providing humidity sensing solutions to OEMS tackling the most demanding of applications. The sensor module is plugs tightly onto a mating cable providing a watertight connection. If the sensor should have problems you can quickly swap out with a new one using no tools, just pull the sensor off and plug in a new one. The sensor is very small making it easy to mount in typical OEM tight spots like ducts and various nooks of OEM equipment. The sintered stainless steel filter provides an extra level of protection against splashes and condensation. The filter by its nature allows water to pass but with minimal shielding such as our 'outdoor hood' this sensor can be mounted outdoors with no issues.

Specifications

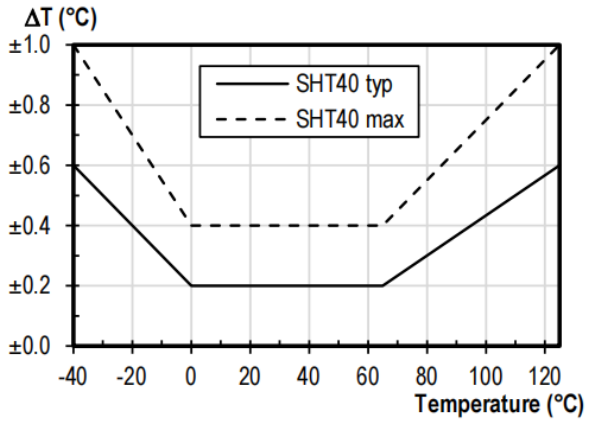
Relative Humidity			
Parameter	Conditions	Value	Units
RH accuracy[1]	typ.	±1.8	%RH
	max.	see Figure 2	-
Repeatability[2]	high	0.08	%RH
	medium	0.15	%RH
	low	0.25	%RH
Resolution[3]	-	0.01	%RH
Hysteresis	-	±1	%RH
Specified range[4]	extended[5]	0 to 100	%RH
Response time[6]	$t_{63\%}$	6	s
Long-term drift[7]	typ	<0.25	%RH/y
Temperature			
Parameter	Conditions	Value	Units
Accuracy[1]	typ.	±0.2	°C
Repeatability[2]	high	0.04	°C
	medium	0.07	°C
	low	0.1	°C
Resolution[3]	-	0.01	°C
Specified range[4]	-	–40 to +125	°C
Response time[8]	$t_{63\%}$	2	s
Long-term drift[9]	typ.	<0.03	°C/y

1 For definition of typ. and max. accuracy, please refer to the document "Sensirion Humidity Sensor Specification Statement"
2 The stated repeatability is 3 times the standard deviation (3σ) of multiple consecutive measurement values at constant conditions and is a measure for the noise
on the physical sensor output. Different repeatability commands are listed in Table 7.
3 Resolution of A/D converter.
4 Specified range refers to the range for which the humidity or temperature sensor specification is guaranteed.
5 For details about recommended humidity and temperature operating range, please refer to section 2.3.

6 Time for achieving 63% of a humidity step function, measured at 25°C and 1 m/s airflow. Humidity response time in the application depends on the design-in of the
sensor.
7 Typical value for operation in normal RH/T operating range. Max. value is < 0.5 %RH/y. Value may be higher in environments with vaporized solvents, out-gassing
tapes, adhesives, packaging materials, etc. For more details please refer to Handling Instructions.
8 Temperature response time depends on heat conductivity of sensor substrate and design-in of sensor in application.
9 Max. value is < 0.04°C/y.

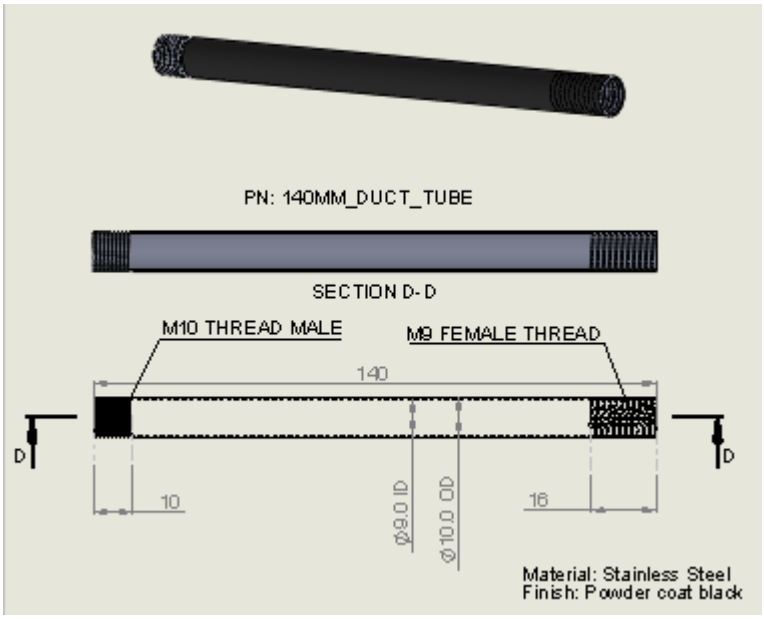


SHT40 typical and maximal relative humidity accuracy at 25 °C



SHT40 typical and maximal temperature accuracy.

There will be a few accessories as well such as extension pipe, stainless steel sintered filter, pluggable connector, high temperature silicon cable, etc.



Here following one picture to show HM-D1-S use

Outdoor temp transducer,3m Cable,with waterproof connector.