

# Erriez DHT22 library for Arduino

1.1.1

Generated by Doxygen 1.8.11



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# Chapter 1

## DHT22 - AM2302/AM2303 temperature and humidity sensor library for Arduino

This is an Arduino library for the calibrated AM2302/AM2303 digital temperature and relative humidity sensor on a [DHT22](#) breakout PCB.

### Library features

- Read 16-bit temperature (synchronous blocking)
- Read 16-bit relative humidity (synchronous blocking)
- Configurable number of read retries when a read error occurs (default is 1 read + 2 retries)
- Long time duration example
- Temperature and humidity average with a configurable number of samples to remove jitter

### AM2302/AM2303 sensor specifications

- Voltage: 3.3 .. 5V
- Ultra-low power:
  - Typical 15uA dormancy
  - Typical 500uA measuring
- Single wire digital serial interface
- Calibrated digital signal
- Outstanding long term stability
- No additional electronic components needed
- Humidity:
  - Range: 0 .. 99.9 RH (Relative Humidity)
  - Resolution: 0.1 RH
  - Accuracy: +/-2 RH (at 25 degree Celsius)

- Temperature:
  - Range: -40 .. +125 degree Celsius
  - Resolution: 0.1 degree Celsius
  - Accuracy: +/- 0.4 degree Celsius
- Minimum read interval: 2000 ms
- ~31ms to synchronous read humidity, temperature and parity data from sensor (5 Bytes)

## Safety warning

According to the datasheet, the AM2302/AM2303 is a low cost consumer temperature sensor. It may not be used in safety critical applications, emergency stop devices or any other occasion that failure of AM2302/AM2303 may cause personal injury.

## Hardware

### Pull-up resistor DAT pin

- Connect an external 3k3 . . 10k pull-up resistor between the DAT and VCC pins only when:
  - Using a AM2302/AM2303 sensor without a DT22 breakout PCB **and** the MCU IO pin has no built-in or external pull-up resistor.
- The [DHT22](#) breakout PCB contains a 3k3 pull-up resistor between DAT and VCC.
- Please refer to the MCU datasheet or board schematic for more information about IO pin pull-up resistors.

### External capacitor

- Tip: Connect a 100nF capacitor between the sensor pins VCC and GND when read errors occurs. This may stabilize the power supply.

Board - <a href="#">DHT22</a> pins	VCC	GND	DAT
Arduino UNO / Nano / Micro (ATMega328 boards)	5V (or 3V3)	GND	2 (DIGITAL pin)
Arduino Leonardo	5V (or 3V3)	GND	2 (DIGITAL pin)
Arduino Mega2560	5V (or 3V3)	GND	2 (DIGITAL pin)
Arduino DUE (ATSAM3X8E)	3V3	GND	2 (DIGITAL pin)
ESP8266 (ESP12E / WeMos D1 R2 / NodeMCU v2 or v3)	3V3	GND	GPIO4 (D2)
ESP32 (WeMos Lolin32 OLED / WeMos LOLIN D32)	3V3	GND	GPIO4

### Notes:

- GPIO4 uses sketch pin number 4 and is labeled as D2 on some WeMos ESP8266 boards.
- Other MCU's may work, but are not tested.

## Examples

Arduino IDE | Examples | Erriez [DHT22](#) Temperature & Humidity:

- [DHT22](#)
- [DHT22Average](#)
- [DHT22DurationTest](#)

## Documentation

- [Doxygen online HTML](#)
- [Doxygen PDF](#)
- [AM2303 datasheet](#)
- [DHT22 datasheet](#)

## Usage

### Initialization

```
1 {c++}
2 #include <ErriezDHT22.h>
3
4 // Connect DHT22 DAT pin to Arduino board
5
6 // Connect DHT22 DAT pin to Arduino DIGITAL pin
7 #if defined(ARDUINO_ARCH_AVR) || defined(ARDUINO_SAM_DUE)
8 #define DHT22_PIN 2
9 #elif defined(ESP8266) || defined(ESP32)
10 #define DHT22_PIN 4 // GPIO4 (Labeled as D2 on some ESP8266 boards)
11 #else
12 #error "May work, but not tested on this target"
13 #endif
14
15 DHT22 sensor = DHT22(DHT22_PIN);
16
17 void setup()
18 {
19     // Initialize serial port
20     Serial.begin(115200);
21     Serial.println(F("DHT22 temperature and humidity sensor example\n"));
22
23     // Initialize sensor
24     sensor.begin();
25 }
```

### Read temperature and humidity

```
1 {c++}
2 void loop()
3 {
4     // Check minimum interval of 2000 ms between sensor reads
5     if (sensor.available()) {
6         // Read temperature from sensor
7         int16_t temperature = sensor.readTemperature();
8
9         // Read humidity from sensor
10        int16_t humidity = sensor.readHumidity();
11
12        if (temperature == ~0) {
13            // Print error (Check hardware connection)
14            Serial.print(F("Temperature: Error"));
15        } else {
```

```
16         // Print temperature
17         Serial.print(F("Temperature: "));
18         Serial.print(temperature / 10);
19         Serial.print(F("."));
20         Serial.print(temperature % 10);
21         Serial.println(F(" *C"));
22     }
23
24     if (humidity == ~0) {
25         // Print error (Check hardware connection)
26         Serial.print(F("Humidity: Error"));
27     } else {
28         // Print humidity
29         Serial.print(F("Humidity: "));
30         Serial.print(humidity / 10);
31         Serial.print(F("."));
32         Serial.print(humidity % 10);
33         Serial.println(F(" %"));
34     }
35
36     Serial.println();
37 }
38 }
```

### Serial output

```
1 DHT22 temperature and humidity sensor example
2
3 Temperature: 17.7 *C
4 Humidity: 41.0 %
5
6 Temperature: 17.8 *C
7 Humidity: 41.1 %
8
9 ...
```

### Library dependencies

- None

### Library installation

Please refer to the [Wiki](#) page.

### Other Arduino Libraries and Sketches from Erriez

- [Erriez Libraries and Sketches](#)



## Chapter 2

# Class Index

### 2.1 Class List

Here are the classes, structs, unions and interfaces with brief descriptions:

<a href="#">DHT22</a>	
<a href="#">DHT22</a> sensor class	9



## Chapter 3

# File Index

### 3.1 File List

Here is a list of all documented files with brief descriptions:

<a href="#">ErriezDHT22.cpp</a>	
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<a href="#">ErriezDHT22.h</a>	
<a href="#">DHT22</a> (AM2302/AM2303) Humidity and Temperature sensor library for Arduino . . . . .	13



## Chapter 4

# Class Documentation

### 4.1 DHT22 Class Reference

DHT22 sensor class.

```
#include <ErriezDHT22.h>
```

#### Public Member Functions

- [DHT22](#) (uint8\_t pin)  
*Constructor [DHT22](#) sensor.*
- void [begin](#) (uint8\_t maxReadRetries=2, uint8\_t numSamples=0)  
*Initialize sensor.*
- bool [available](#) ()  
*Check if new temperature or humidity read is allowed.*
- bool [readSensorData](#) ()  
*Read data from sensor.*
- int16\_t [readTemperature](#) ()  
*Read temperature from sensor.*
- int16\_t [readHumidity](#) ()  
*Read humidity from sensor.*
- uint8\_t [getNumRetriesLastConversion](#) ()  
*Get number of retries during last conversion.*

#### 4.1.1 Detailed Description

DHT22 sensor class.

According to the datasheet, the AM2302/AM2303 is a low cost consumer temperature sensor. It may not be used in safety critical applications, emergency stop devices or any other occasion that failure of AM2302/AM2303 may cause personal injury.

The AM2302/AM2303 is factory calibrated. However, deviation may occur with aging.

The temperature/humidity read interval in this library is cached for 2 seconds to prevent heating-up the internal chip with continues reading.

Global interrupts are disabled during a synchronous sensor read transfer. This is required to sample the data bit lengths at maximum speed on low-end devices without any application interrupts. The read calls are protected with a timeout.

The application is responsible for checking  $\sim 0$  values after a read which means that the read failed or a timeout occurred. Multiple reads by the application with an average calculation is recommended.

Definition at line 80 of file ErriezDHT22.h.

## 4.1.2 Constructor & Destructor Documentation

### 4.1.2.1 DHT22::DHT22 ( uint8\_t *pin* ) [explicit]

Constructor [DHT22](#) sensor.

#### Parameters

<i>pin</i>	Data pin sensor.
------------	------------------

Definition at line 39 of file ErriezDHT22.cpp.

## 4.1.3 Member Function Documentation

### 4.1.3.1 bool DHT22::available ( )

Check if new temperature or humidity read is allowed.

The application should call this function and check if a new temperature and humidity can be read to prevent too fast sensor reads.

#### Return values

<i>true</i>	Available, interval between sensor reads $\geq$ 2000 ms and sensor read was successful.
<i>false</i>	Not available, interval between sensor reads too short, or read failed.

Definition at line 109 of file ErriezDHT22.cpp.

### 4.1.3.2 void DHT22::begin ( uint8\_t *maxReadRetries* = 2, uint8\_t *numSamples* = 0 )

Initialize sensor.

#### Parameters

<i>maxReadRetries</i>	Maximum number of sensor read retries after a sensor read error. Set maxReadRetries to 0 to read data from sensor once. Default value: 2
<i>numSamples</i>	Number of samples to calculate temperature and humidity average. This allocates <code>sizeof(int16_t) * number of samples</code> . Value 0 (default) will disable average calculation.

Call this function from `setup()`.  
 \n

- Connect an external 3k3..10k pull-up resistor between the DAT and VCC pins only when:  
   - using a AM2302/AM2303 sensor without a DHT22 breakout PCB  
   AND  
   - the MCU IO pin has no built-in or external pull-up resistor.  
 \n
- The DHT22 breakout PCB contains a 3k3 pull-up resistor between DAT and VCC.  
 \n
- Please refer to the MCU datasheet or board schematic for more information about IO pin  
 pull-up resistors.

Definition at line 80 of file ErriezDHT22.cpp.

#### 4.1.3.3 `uint8_t DHT22::getNumRetriesLastConversion ( )`

Get number of retries during last conversion.

##### Returns

Number of retries during sensor read. Value 0 is one successful read without retries.

Definition at line 212 of file `ErriezDHT22.cpp`.

#### 4.1.3.4 `int16_t DHT22::readHumidity ( )`

Read humidity from sensor.

##### Return values

<i>Humidity</i>	Signed humidity with last digit after the point.
$\sim 0$	Invalid conversion: Sensor read error occurred. Use <a href="#">getNumRetriesLastConversion()</a> to get number of read retries.

Definition at line 174 of file `ErriezDHT22.cpp`.

#### 4.1.3.5 `bool DHT22::readSensorData ( )`

Read data from sensor.

5 Bytes data will be read when interval between previous read  $\geq$  2000 ms.

The sensor data is read until a valid conversion has been performed, or limited to the maximum number of read retries as specified with `begin(numRetries)`. A valid conversion consists of:

- A valid start condition
- A successful sensor read (5 Bytes data)
- A correct checksum

##### Return values

<i>true</i>	Last conversion was successful.
<i>false</i>	Last conversion was unsuccessful.

Definition at line 233 of file `ErriezDHT22.cpp`.

#### 4.1.3.6 `int16_t DHT22::readTemperature ( )`

Read temperature from sensor.

Returns the actual temperature, or a cached temperature when read interval is too short.

## Return values

<i>Temperature</i>	Signed temperature with last digit after the point.
<i>~0</i>	Invalid conversion: Sensor read occurred. Use <a href="#">getNumRetriesLastConversion()</a> to get number of read retries.

Definition at line 130 of file ErriezDHT22.cpp.

The documentation for this class was generated from the following files:

- [ErriezDHT22.h](#)
- [ErriezDHT22.cpp](#)



## Chapter 5

# File Documentation

### 5.1 ErriezDHT22.cpp File Reference

[DHT22](#) (AM2302/AM2303) Humidity and Temperature sensor library for Arduino.

```
#include "ErriezDHT22.h"
```

#### 5.1.1 Detailed Description

[DHT22](#) (AM2302/AM2303) Humidity and Temperature sensor library for Arduino.

Source: <https://github.com/Erriez/ErriezDHT22> Documentation: <https://erriez.github.io/ErriezDHT22>

### 5.2 ErriezDHT22.h File Reference

[DHT22](#) (AM2302/AM2303) Humidity and Temperature sensor library for Arduino.

```
#include <Arduino.h>
```

#### Classes

- class [DHT22](#)  
*DHT22 sensor class.*

#### Macros

- #define [DHT22\\_MIN\\_READ\\_INTERVAL](#) 2000  
*Enable debug prints to Serial.*
- #define [DHT22\\_NUM\\_DATA\\_BITS](#) (5 \* 8)
- #define [DEBUG\\_PRINTLN](#)(...) {}  
*Debug print configuration.*

### 5.2.1 Detailed Description

**DHT22** (AM2302/AM2303) Humidity and Temperature sensor library for Arduino.

Source: <https://github.com/Erriez/ErriezDHT22> Documentation: <https://erriez.github.io/ErriezDHT22>

### 5.2.2 Macro Definition Documentation

#### 5.2.2.1 `#define DHT22_MIN_READ_INTERVAL 2000`

Enable debug prints to Serial.

Minimum interval between sensor reads in milli seconds

Definition at line 42 of file ErriezDHT22.h.

#### 5.2.2.2 `#define DHT22_NUM_DATA_BITS (5 * 8)`

Number of data bits is 5 Bytes \* 8 bits: 1 Byte: Humidity high 1 Byte: Humidity low 1 Byte: Temperature high 1 Byte: Temperature low 1 Byte: Parity

Definition at line 50 of file ErriezDHT22.h.

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