

# BH1750 library for Arduino

## 1.0.0

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# Chapter 1

## BH1750 digital light sensor library for Arduino

This is a 16-bit [BH1750](#) digital ambient light sensor on a GY-302 breakout PCB:

### Arduino library features

- Measurement in LUX
- Three operation modes:
  - Continues conversion
  - One-time conversion
- Three selectable resolutions:
  - Low 4 LUX resolution (low power)
  - High 1 LUX resolution
  - High 0.5 LUX resolution
- Asynchronous and synchronous conversion

### [BH1750](#) sensor specifications

- Operating voltage: 3.3V .. 4.5V max
- Low current by power down: max 1uA
- I2C bus interface: max 400kHz
- Ambience light:
  - Range: 1 - 65535 lx
  - Deviation: +/- 20%
  - Selectable resolutions:
    - \* 4 lx (low resolution, max 24 ms measurement time)
    - \* 1 lx (mid resolution max 180 ms measurement time)
    - \* 0.5 lx (high resolution 180 ms measurement time)
- No additional electronic components needed

## GY-302 breakout specifications

- Supply voltage: 3.3 .. 5V
- 5V tolerant I2C SCL and SDA pins
- 2 selectable I2C addresses with ADDR pin high or low/floating

## Hardware

### Connection **BH1750** - Arduino board

<b>BH1750</b>	<b>Arduino UNO / Nano</b>	<b>Leonardo / Pro Micro</b>	<b>Mega2560</b>
GND	GND	GND	GND
VCC	5V (or 3.3V)	5V (or 3.3V)	5V (or 3.3V)
SDA	A4	D2	D20
SCL	A5	D3	D21

### I2C address

- ADDR pin LOW for I2C address 0x23 (0x46 including R/W bit)
- ADDR pin HIGH for I2C address 0x5C (0xB8 including R/W bit)

**Note:** ADDR pin may be floating (open) which is the same as LOW.

## Supported Arduino Boards

- All ATmega328P MCU's:
  - Arduino UNO
  - Arduino Nano
- All ATmega32U4 MCU's:
  - Arduino Leonardo
  - Pro Micro
- All ATmega2560 MCU's:
  - Arduino Mega2560
- All ESP8266 boards:
  - WeMos D1 R2
  - NodeMCU
- All Lolin32 boards:
  - WeMos Lolin32
- Other MCU's may work, but are not tested.

## Library dependencies

- Built-in `Wire.h`

## Documentation

- [Doxygen PDF](#) (Documentation library source code)
- [BH1750 chip datasheet](#)

## Examples

Examples | Erriez [BH1750](#):

- ContinuesMode | [BH1750ContinuesAsynchronous](#)
- ContinuesMode | [BH1750ContinuesBasic](#)
- ContinuesMode | [BH1750ContinuesHighResolution](#)
- ContinuesMode | [BH1750ContinuesLowResolution](#)
- ContinuesMode | [BH1750ContinuesPowerMgt](#)
- OneTimeMode | [BH1750OneTimeBasic](#)
- OneTimeMode | [BH1750OneTimeHighResolution](#)
- OneTimeMode | [BH1750OneTimeLowResolution](#)
- OneTimeMode | [BH1750OneTimePowerMgt](#)

## Example continues conversion high resolution

```
{c++}
#include <Wire.h>
#include <BH1750.h>

// ADDR line LOW/open: I2C address 0x23 (0x46 including R/W bit) [default]
// ADDR line HIGH: I2C address 0x5C (0xB8 including R/W bit)
BH1750 sensor(LOW);

void setup()
{
  Serial.begin(115200);
  Serial.println(F("BH1750 continues measurement high resolution example"));

  // Initialize I2C bus
  Wire.begin();

  // Initialize sensor in continues mode, high 0.5 lx resolution
  sensor.begin(ModeContinuous, ResolutionHigh);

  // Start conversion
  sensor.startConversion();
}

void loop()
{
  uint16_t lux;

  // Wait for completion (blocking busy-wait delay)
  if (sensor.isConversionCompleted()) {
    // Read light
    lux = sensor.read();

    // Print light
    Serial.print(F("Light: "));
    Serial.print(lux / 2);
    Serial.print(F("."));
    Serial.print(lux % 10);
    Serial.println(F(" LUX"));
  }
}
```

## Output

```
{c++}
BH1750 continues measurement high resolution example
Light: 15.0 LUX
Light: 31.2 LUX
Light: 385.0 LUX
Light: 575.1 LUX
Light: 667.5 LUX
```

## Usage

### Initialization

```
{c++}
#include <Wire.h>
#include <BH1750.h>

// ADDR line LOW/open: I2C address 0x23 (0x46 including R/W bit) [default]
// ADDR line HIGH:     I2C address 0x5C (0xB8 including R/W bit)
BH1750 sensor(LOW);

void setup()
{
    // Initialize I2C bus
    Wire.begin();

    // Initialize sensor with a mode and resolution:
    // Modes:
    //   ModeContinuous
    //   ModeOneTime
    // Resolutions:
    //   ResolutionLow (4 lx resolution)
    //   ResolutionMid (1 lx resolution)
    //   ResolutionHigh (0.5 lx resolution)
    sensor.begin(mode, resolution);
}
```

### Start conversion

```
{Wire.begin(); ``}

``c++
sensor.startConversion();
```

### Wait for completion asynchronous (non-blocking)

The sensor conversion completion status can be checked asynchronously before reading the light value:

```
{c++}
bool completed = sensor.isConversionCompleted();
```

### Wait for completion synchronous (blocking)

The sensor conversion completion status can be checked synchronously before reading the light value:

```
{c++}
// Wait for completion
// completed = false: Timeout or device in power-down
bool completed = sensor.waitForCompletion();
```



---

## Read light value in LUX

**One-time mode:** The application must wait or check for a completed conversion, otherwise the sensor may return an invalid value. **Continues mode:** The application can call this function without checking completion, but is not recommended when accurate values are required.

Read sensor light value:

```
{c++}  
// lux = 0: No light or not initialized  
uint16_t lux = sensor.read();
```

For 4 lx low and 1 lx high resolutions:

```
{c++}  
// Print low and medium resolutions  
Serial.print(F("Light: "));  
Serial.print(lux);  
Serial.println(F(" LUX"));
```

For 0.5 lx high resolution:

```
{c++}  
// Print high resolution  
Serial.print(F("Light: "));  
Serial.print(lux / 2);  
Serial.print(F("."));  
Serial.print(lux % 10);  
Serial.println(F(" LUX"));
```

## Power down

The device enters power down automatically after a one-time conversion.

A manual power-down in continues mode can be generated by calling:

```
{c++}  
sensor.powerDown();
```



## Chapter 2

# Class Index

### 2.1 Class List

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

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## Chapter 3

# File Index

### 3.1 File List

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

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## Chapter 4

# Class Documentation

### 4.1 BH1750 Class Reference

BH1750 class.

```
#include <BH1750.h>
```

#### Public Member Functions

- **BH1750** (uint8\_t addrPinLevel=LOW)  
*Constructor.*
- virtual void **begin** (BH1750\_Mode\_e mode, BH1750\_Resolution\_e resolution)  
*Set mode and resolution.*
- virtual void **powerDown** ()  
*Power down. Call **startConversion()** to power-up automatically.*
- virtual void **startConversion** ()  
*Start conversion.*
- virtual bool **isConversionCompleted** ()  
*Wait for completion.*
- virtual bool **waitForCompletion** ()  
*Wait for completion.*
- virtual uint16\_t **read** ()  
*Read light level asynchronous from sensor The application is responsible for wait or checking a completed conversion, otherwise the last conversion value may be returned which may not be correct. The last value is also returned when the device is in power-down.*

#### Protected Member Functions

- virtual void **writeInstruction** (uint8\_t instruction)  
*Write instruction to sensor.*
- virtual void **setTimestamp** ()  
*Save current time + minimum delay before reading next conversion in ms.*

### 4.1.1 Detailed Description

[BH1750](#) class.

Definition at line 54 of file BH1750.h.

### 4.1.2 Constructor & Destructor Documentation

#### 4.1.2.1 BH1750()

```
BH1750::BH1750 (
    uint8_t addrPinLevel = LOW ) [explicit]
```

Constructor.

Parameters

<i>addrPinLevel</i>	Sensor I2C address: ADDR pin = LOW: 0x23 (default) ADDR pin = HIGH: 0x5C
---------------------	--

Definition at line 45 of file BH1750.cpp.

### 4.1.3 Member Function Documentation

#### 4.1.3.1 begin()

```
void BH1750::begin (
    BH1750_Mode_e mode,
    BH1750_Resolution_e resolution ) [virtual]
```

Set mode and resolution.

Parameters

<i>mode</i>	ModeContinuous for continues mode Continues conversion requires more power ModeOneTime for one-time conversion mode Set in low power when conversion completed
<i>resolution</i>	Resolution05Lux for high resolution (max 180ms conversion) Resolution1Lux for normal resolution (max 180ms conversion) Resolution4Lux for low resolution (max 24ms conversion, low power)

Definition at line 67 of file BH1750.cpp.



#### 4.1.3.2 isConversionCompleted()

```
bool BH1750::isConversionCompleted ( ) [virtual]
```

Wait for completion.

##### Returns

true: Conversion completed false: Conversion busy

Definition at line 106 of file BH1750.cpp.

#### 4.1.3.3 read()

```
uint16_t BH1750::read ( ) [virtual]
```

Read light level asynchronous from sensor The application is responsible for wait or checking a completed conversion, otherwise the last conversion value may be returned which may not be correct. The last value is also returned when the device is in power-down.

##### Returns

Light level in lux (0..65535) In high resolution, the last digit is the remainder

Definition at line 163 of file BH1750.cpp.

#### 4.1.3.4 waitForCompletion()

```
bool BH1750::waitForCompletion ( ) [virtual]
```

Wait for completion.

##### Returns

true: Conversion completed false: Not initialized, or timeout

Definition at line 126 of file BH1750.cpp.

#### 4.1.3.5 writeInstruction()

```
void BH1750::writeInstruction (
    uint8_t instruction ) [protected], [virtual]
```

Write instruction to sensor.

**Parameters**

<i>instruction</i>	Sensor instruction
--------------------	--------------------

Definition at line 216 of file BH1750.cpp.

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

- [src/BH1750.h](#)
- [src/BH1750.cpp](#)

## Chapter 5

# File Documentation

### 5.1 src/BH1750.cpp File Reference

[BH1750](#) digital light sensor library for Arduino.

```
#include "BH1750.h"  
#include "BH1750_priv.h"
```

#### 5.1.1 Detailed Description

[BH1750](#) digital light sensor library for Arduino.

[BH1750.cpp](#)

Source: <https://github.com/Erriez/ErriezBH1750>

### 5.2 src/BH1750.h File Reference

[BH1750](#) digital light sensor library for Arduino.

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

#### Classes

- class [BH1750](#)  
*[BH1750](#) class.*

## Enumerations

- enum [BH1750\\_Mode\\_e](#) { [ModeContinuous](#) = 0x10, [ModeOneTime](#) = 0x20 }  
*Mode register bits.*
- enum [BH1750\\_Resolution\\_e](#) { [ResolutionLow](#) = 0x03, [ResolutionMid](#) = 0x00, [ResolutionHigh](#) = 0x01 }  
*Resolution register bits.*

### 5.2.1 Detailed Description

[BH1750](#) digital light sensor library for Arduino.

[BH1750.h](#)

Source: <https://github.com/Erriez/ErriezBH1750>

### 5.2.2 Enumeration Type Documentation

#### 5.2.2.1 BH1750\_Mode\_e

enum [BH1750\\_Mode\\_e](#)

Mode register bits.

Enumerator

<a href="#">ModeContinuous</a>	Continues mode.
<a href="#">ModeOneTime</a>	One-time mode.

Definition at line 41 of file [BH1750.h](#).

#### 5.2.2.2 BH1750\_Resolution\_e

enum [BH1750\\_Resolution\\_e](#)

Resolution register bits.

Enumerator

<a href="#">ResolutionLow</a>	4 lx resolution
<a href="#">ResolutionMid</a>	1 lx resolution
<a href="#">ResolutionHigh</a>	0.5 lx resolution

Definition at line 47 of file BH1750.h.

## 5.3 src/BH1750\_priv.h File Reference

[BH1750](#) digital light sensor library for Arduino.

### Macros

- `#define BH1750_I2C_ADDR_L 0x23`  
*I2C address with ADDR pin low.*
- `#define BH1750_I2C_ADDR_H 0x5C`  
*I2C address with ADDR pin high.*
- `#define BH1750_POWER_DOWN 0x00`  
*Power down instruction.*
- `#define BH1750_POWER_ON 0x01`  
*Power on instruction.*
- `#define BH1750_RESET 0x07`  
*Reset instruction.*
- `#define BH1750_MODE_MASK 0x30`  
*Mode mask bits.*
- `#define BH1750_RES_MASK 0x03`  
*Mode resolution mask bits.*
- `#define BH1750_CONV_TIME_L 24`  
*Worst case conversion timing low res.*
- `#define BH1750_CONV_TIME_H 180`  
*Worst case conversion timing high res.*
- `#define IS_INITIALIZED(mode) (((mode) & BH1750_MODE_MASK) != 0x00)`
- `#define IS_CONTINUES_MODE(mode) (((mode) & BH1750_MODE_MASK) == ModeContinuous)`
- `#define IS_ONE_TIME_MODE(mode) (((mode) & BH1750_MODE_MASK) == ModeOneTime)`
- `#define IS_LOW_RESOLUTION(mode) (((mode) & BH1750_RES_MASK) == ResolutionLow)`
- `#define GET_TIMEOUT(mode)`

### 5.3.1 Detailed Description

[BH1750](#) digital light sensor library for Arduino.

[BH1750\\_priv.h](#)

Source: <https://github.com/Erriez/ErriezBH1750>

### 5.3.2 Macro Definition Documentation

### 5.3.2.1 GET\_TIMEOUT

```
#define GET_TIMEOUT(  
    mode )
```

**Value:**

```
(( (mode) & BH1750_RES_MASK) == ResolutionLow) ? \  
    BH1750_CONV_TIME_L :  
    BH1750_CONV_TIME_H)
```

Macro low/high resolution timeout from mode

Definition at line 82 of file BH1750\_priv.h.

### 5.3.2.2 IS\_CONTINUES\_MODE

```
#define IS_CONTINUES_MODE(  
    mode ) (( (mode) & BH1750_MODE_MASK) == ModeContinuous)
```

Macro is continues mode enabled

Definition at line 64 of file BH1750\_priv.h.

### 5.3.2.3 IS\_INITIALIZED

```
#define IS_INITIALIZED(  
    mode ) (( (mode) & BH1750_MODE_MASK) != 0x00)
```

Return if mode is set (initialized)

Definition at line 58 of file BH1750\_priv.h.

### 5.3.2.4 IS\_LOW\_RESOLUTION

```
#define IS_LOW_RESOLUTION(  
    mode ) (( (mode) & BH1750_RES_MASK) == ResolutionLow)
```

Macro is low resolution enabled from mode

Definition at line 76 of file BH1750\_priv.h.

### 5.3.2.5 IS\_ONE\_TIME\_MODE

```
#define IS_ONE_TIME_MODE(  
    mode ) (( (mode) & BH1750_MODE_MASK) == ModeOneTime)
```

Macro is one-time mode enabled from mode

Definition at line 70 of file BH1750\_priv.h.

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