

Erriez DS3231 high precision I2C RTC library for Arduino  
1.0.1

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# Chapter 1

## DS3231 high precision I2C RTC library for Arduino

This is an advanced [DS3231](#) high precision I2C RTC library for Arduino.

### Library features

- Read time
- Set time
- Read date and time
- Set date and time
- Read Unix Epoch UTC 32-bit timestamp
- Read temperature (0.25 degree resolution)
- Alarm 1 (second/minute/hour/day/date match)
- Alarm 2 (minute/hour/day/date match)
- Polling and Alarm `INT`/`SQW` interrupt pin
- Control 32kHz out signal (enable/disable)
- Control `SQW` signal (disable/1/1024/4096/8192Hz)
- Configure aging offset
- Serial terminal interface
- Full RTC register access
- Easy debug functionality
- Basic and advanced examples
- Set date/time over serial with Python script
- Low RAM footprint:
  - `sizeof(DS3231)` : 1 Byte RTC object.
  - `sizeof(DS3231_DateTime)` : 8 Bytes date/time object.
- Full Doxygen documentation

## Hardware

Any Arduino hardware with a TWI interface and `Wire.h` support.

## ESP32 notes

**ESP32 problem:** The Arduino IDE | Board manager installs an old version 1.0.0 from [https://dl.espressif.com/dl/package\\_esp32\\_index.json](https://dl.espressif.com/dl/package_esp32_index.json) which contains a broken I2C repeated start. Generating a repeated start with `Wire.endTransmission(false)`; results in reading zero's from any I2C device and is not a problem of this library.

**Solution:** Use the Git master branch (or a newer release when available) to solve this problem as described on: <https://github.com/espressif/arduino-esp32/blob/master/docs/arduino-ide/windows.md>.

## Pins

Pins board - <b>DS3231</b>	VCC	GND	SDA	SCL	SQW
Arduino UNO (ATMega328 boards)	5V	GND	A4	A5	D2 (INT0)
Arduino Mega2560	5V	GND	D20	D21	D2 (INT4)
Arduino Leonardo	5V	GND	D2	D3	D7 (INT6)
Arduino DUE (ATSAM3X8E)	3V3	GND	20	21	2
ESP8266	3V3	GND	GPIO4 (D2)	GPIO5 (D1)	GPIO0 (D3)
ESP32	3V3	GND	GPIO21	GPIO22	GPIO0

Note: Tested ESP8266 / ESP32 boards:

- **ESP8266 boards:** ESP12E / WeMos D1 & R2 / Node MCU v2 / v3
- **ESP32 boards:** WeMos LOLIN32 / LOLIN D32

Other unlisted MCU's may work, but are not tested.

## Examples

Arduino IDE | Examples | Erriez [DS3231](#) RTC:

- [AgingOffset](#) Aging offset programming.
- [AlarmInterrupt](#) Alarm with interrupts.
- [AlarmPolling](#) Alarm polled.
- [GettingStarted](#) Getting started example which contains most date/time/temperature features.
- [Minimum](#) Minimum example to read time.
- [PrintDiagnostics](#) Print diagnostics and registers.
- [ReadTimeInterrupt](#) Read time with 1Hz SQW interrupt. (Highly recommended)
- [ReadTimePolled](#) Read time polled.
- [SetDateTime](#) Set date time. (Must be started first)
- [Temperature](#) Temperature.
- [Terminal](#) Advanced terminal interface with `set date/time Python` script.



## Documentation

- [Doxygen online HTML](#)
- [Doxygen PDF](#)
- [DS3231 datasheet](#)

## Usage

### Initialization

```
{c++}
#include <Wire.h>
#include <ErriezDS3231.h>

// Create DS3231 RTC object
static DS3231 rtc;

void setup()
{
    // Initialize TWI with a 100kHz (default) or 400kHz clock
    Wire.begin();
    Wire.setClock(400000);

    // Initialize RTC
    while (rtc.begin()) {
        // Error: Could not detect DS3231 RTC, retry after some time
        delay(3000);
    }
}
```

### Check oscillator status at startup

```
{c++}
// Check oscillator status
if (rtc.isOscillatorStopped()) {
    // Error: DS3231 RTC oscillator stopped. Date/time cannot be trusted.
    // Set new date/time before reading date/time.
    while (1) {
        ;
    }
}
```

### Set time

```
{c++}
// Write time to RTC
if (rtc.setTime(12, 0, 0)) {
    // Error: Write time failed
}
```

### Get time

```
{c++}
uint8_t hour;
uint8_t minute;
uint8_t second;

// Read time from RTC
if (rtc.getTime(&hour, &minute, &second)) {
    // Error: Read time failed
}
```

### Set date time

```
{c++}
// Create and initialize date time object
static DS3231_DateTime dt = {
    .second = 0,
    .minute = 36,
    .hour = 21,
    .dayWeek = 7, // 1 = Monday
    .dayMonth = 29,
    .month = 7,
    .year = 2018
};

// Set new RTC date/time
rtc.setDateTime(&dt);
```

### Get date time

```
{c++}
DS3231_DateTime dt;

// Read RTC date and time from RTC
if (rtc.getDateTime(&dt)) {
    // Error: Read date time failed
}
```

### Get Epoch Unix UTC time

```
{c++}
uint32_t epoch;

// Read date/time from RTC
if (rtc.getDateTime(&dt)) {
    // Error: Read date/time failed
    return;
}

// Convert date/time to 32-bit epoch time
epoch = rtc.getEpochTime(&dt);
```

### Get temperature

```
{c++}
int8_t temperature;
uint8_t fraction;

// Force temperature conversion
// Without this call, it takes 64 seconds before the temperature is updated.
rtc.startTemperatureConversion();

// Read temperature
rtc.getTemperature(&temperature, &fraction);

// Print temperature. The output below is for example: 28.25C
Serial.print(temperature);
Serial.print(F("."));
Serial.print(fraction);
Serial.println(F("C"));
```

### Program Alarm 1

Note: Alarm 1 and Alarm 2 have different behavior. Please refer to the documentation which Alarm1Type and Alarm2Type are supported. Some examples:

```
{c++}
// Generate alarm 1 every second
rtc.setAlarm1(Alarm1EverySecond, 0, 0, 0, 0);

// Generate alarm 1 every minute and second match
rtc.setAlarm1(Alarm1EverySecond, 0, 0, 45, 30);

// Generate alarm 1 every day, hour, minute and second match
rtc.setAlarm1(Alarm1MatchDay,
    1, // Alarm day match (1 = Monday)
    12, // Alarm hour match
    45, // Alarm minute match
    30 // Alarm second match
);
```

## Program Alarm 2

```
{c++}
// Generate alarm 2 every minute
rtc.setAlarm2(Alarm2EveryMinute, 0, 0, 0);

// Generate alarm 2 every hour, minute match
rtc.setAlarm2(Alarm2MatchHours, 0, 23, 59);

// Generate alarm 2 every date, hour, minute match
rtc.setAlarm2(Alarm2MatchDate, 28, 7, 0);
```

## Alarm polling

Note: The INT pin changes to low when an Alarm 1 or Alarm 2 match occurs and the interrupt is enabled. The pin remains low until both alarm flags are cleared by the application.

```
{c++}
// Poll alarm 1 flag
if (rtc.getAlarmFlag(Alarm1)) {
    // Handle Alarm 1

    // Clear alarm 1 flag
    rtc.clearAlarmFlag(Alarm1);
}

// Poll alarm 2 flag
if (rtc.getAlarmFlag(Alarm2)) {
    // Handle Alarm 2

    // Clear alarm 2 flag
    rtc.clearAlarmFlag(Alarm2);
}
```

## Alarm interrupt

Note: Enabling interrupt will disable the SQW output signal.

```
{c++}
// Uno, Nano, Mini, other 328-based: pin D2 (INT0) or D3 (INT1)
#define INT_PIN 2

// Alarm interrupt flag must be volatile
static volatile bool alarmInterrupt = false;

static void alarmHandler()
{
    // Set global interrupt flag
    alarmInterrupt = true;
}

void setup()
{
    ...

    // Attach to INT0 interrupt falling edge
    pinMode(INT_PIN, INPUT_PULLUP);
    attachInterrupt(digitalPinToInterrupt(INT_PIN), alarmHandler, FALLING);

    // Enable Alarm 1 and 2 interrupts
    rtc.alarmInterruptEnable(Alarm1, true);
    rtc.alarmInterruptEnable(Alarm2, true);
}

void loop()
{
    // Check global alarm interrupt flag
    if (alarmInterrupt) {
        if (rtc.getAlarmFlag(Alarm1)) {
            // Handle alarm 1

            // Clear alarm 1 interrupt
            rtc.clearAlarmFlag(Alarm1);
        }
    }
}
```

```
        if (rtc.getAlarmFlag(Alarm2)) {  
            // Handle alarm 2  
  
            // Clear alarm 2 interrupt  
            rtc.clearAlarmFlag(Alarm2);  
        }  
    }  
}
```

### 32kHz clock out

Enable or disable 32kHz output pin.

```
{c++}  
rtc.outputClockPinEnable(true);    // Enable  
rtc.outputClockPinEnable(false);  // Disable
```

### Square Wave Out (SQW)

Note: Enabling SQW pin will disable the alarm INT signal.

```
{c++}  
rtc.setSquareWave(SquareWaveDisable); // Disable  
rtc.setSquareWave(SquareWave1Hz);     // 1Hz  
rtc.setSquareWave(SquareWave1024Hz);  // 1024Hz  
rtc.setSquareWave(SquareWave4096Hz);  // 4096Hz  
rtc.setSquareWave(SquareWave8192Hz);  // 8192Hz
```

### Library dependencies

- `Wire.h`
- `Terminal.ino` requires `ErriezSerialTerminal` library.

### Library installation

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

### Other Arduino Libraries and Sketches from Erriez

- [Erriez Libraries and Sketches](#)

## Chapter 2

# Hierarchical Index

### 2.1 Class Hierarchy

This inheritance list is sorted roughly, but not completely, alphabetically:

DS3231 . . . . .	<a href="#">13</a>
DS3231Debug . . . . .	<a href="#">28</a>
DS3231_DateTime_s . . . . .	<a href="#">27</a>



## Chapter 3

# Class Index

### 3.1 Class List

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

<a href="#">DS3231</a>		
<a href="#">DS3231</a>	<a href="#">DS3231</a> RTC base class . . . . .	<a href="#">13</a>
<a href="#">DS3231_DateTime_s</a>		
	Date time structure . . . . .	<a href="#">27</a>
<a href="#">DS3231Debug</a>		
<a href="#">DS3231</a>	<a href="#">DS3231</a> RTC debug class . . . . .	<a href="#">28</a>





## Chapter 4

# File Index

### 4.1 File List

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

src/ <a href="#">ErriezDS3231.cpp</a>	
<a href="#">DS3231</a> high precision RTC library for Arduino . . . . .	31
src/ <a href="#">ErriezDS3231.h</a>	
<a href="#">DS3231</a> high precision RTC library for Arduino . . . . .	32
src/ <a href="#">ErriezDS3231_debug.cpp</a>	
<a href="#">DS3231</a> high precision RTC debug library for Arduino . . . . .	37
src/ <a href="#">ErriezDS3231_debug.h</a>	
<a href="#">DS3231</a> high precision RTC debug library for Arduino . . . . .	39



## Chapter 5

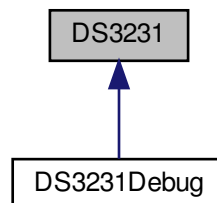
# Class Documentation

### 5.1 DS3231 Class Reference

[DS3231](#) RTC base class.

```
#include <ErriezDS3231.h>
```

Inheritance diagram for DS3231:



#### Public Member Functions

- bool [begin](#) ()  
*Initialize and detect [DS3231](#) RTC.*
- void [oscillatorEnable](#) (bool enable)  
*Enable or disable oscillator when running on V-BAT.*
- bool [isOscillatorStopped](#) ()  
*Read RTC OSF (Oscillator Stop Flag) from status register.*
- void [clearOscillatorStopFlag](#) ()  
*Clear Oscillator Stop Flag (OSF) in status register.*
- void [setDateTime](#) ([DS3231\\_DateTime](#) \*dateTime)  
*Write date and time to RTC.*
- bool [getDateTime](#) ([DS3231\\_DateTime](#) \*dateTime)

- Read date and time from RTC.*

  - void [setTime](#) (uint8\_t hour, uint8\_t minute, uint8\_t second)

*Write time to RTC.*

  - bool [getTime](#) (uint8\_t \*hour, uint8\_t \*minute, uint8\_t \*second)

*Read time from RTC.*

  - uint32\_t [getEpochTime](#) ([DS3231\\_DateTime](#) \*dateTime)

*Get Unix Epoch 32-bit timestamp in current timezone.*

  - void [setAlarm1](#) ([Alarm1Type](#) alarmType, uint8\_t dayDate, uint8\_t hours, uint8\_t minutes, uint8\_t seconds)

*Set Alarm 1.*

  - void [setAlarm2](#) ([Alarm2Type](#) alarmType, uint8\_t dayDate, uint8\_t hours, uint8\_t minutes)

*Set Alarm 2.*

  - void [alarmInterruptEnable](#) ([AlarmId](#) alarmId, bool enable)

*Enable or disable Alarm 1 or 2 interrupt.*

  - bool [getAlarmFlag](#) ([AlarmId](#) alarmId)

*Get Alarm 1 or 2 flag.*

  - void [clearAlarmFlag](#) ([AlarmId](#) alarmId)

*Clear alarm flag.*

  - void [setSquareWave](#) ([SquareWave](#) squareWave)

*Configure SQW (Square Wave) output pin.*

  - void [outputClockPinEnable](#) (bool enable)

*Enable or disable 32kHz output clock pin.*

  - void [setAgingOffset](#) (int8\_t val)

*Set aging offset register.*

  - int8\_t [getAgingOffset](#) ()

*Get aging offset register.*

  - void [startTemperatureConversion](#) ()

*Start temperature conversion.*

  - void [getTemperature](#) (int8\_t \*temperature, uint8\_t \*fraction)

*Read temperature.*

  - uint8\_t [bcdToDec](#) (uint8\_t bcd)

*BCD to decimal conversion.*

  - uint8\_t [decToBcd](#) (uint8\_t dec)

*Decimal to BCD conversion.*

  - uint8\_t [readControlRegister](#) ()

*Read control register.*

  - void [writeControlRegister](#) (uint8\_t value)

*Write control register.*

  - uint8\_t [readStatusRegister](#) ()

*Read status register.*

  - void [writeStatusRegister](#) (uint8\_t value)

*Write status register.*

  - uint8\_t [readRegister](#) (uint8\_t reg)

*Read register.*

  - void [writeRegister](#) (uint8\_t reg, uint8\_t value)

*Write to RTC register.*

  - void [readBuffer](#) (uint8\_t reg, void \*buffer, uint8\_t len)

*Read buffer from RTC.*

  - void [writeBuffer](#) (uint8\_t reg, void \*buffer, uint8\_t len)

*Write buffer to RTC.*

### 5.1.1 Detailed Description

[DS3231](#) RTC base class.

Definition at line 161 of file ErriezDS3231.h.

### 5.1.2 Member Function Documentation

#### 5.1.2.1 alarmInterruptEnable()

```
void DS3231::alarmInterruptEnable (
    AlarmId alarmId,
    bool enable )
```

Enable or disable Alarm 1 or 2 interrupt.

Enabling the alarm interrupt will disable the Square Wave output on the INT/SQW pin. The INT pin remains high until an alarm match occurs.

##### Parameters

<i>alarmId</i>	Alarm1 or Alarm2 enum.
<i>enable</i>	true: Enable alarm interrupt. false: Disable alarm interrupt.

Definition at line 417 of file ErriezDS3231.cpp.

#### 5.1.2.2 bcdToDec()

```
uint8_t DS3231::bcdToDec (
    uint8_t bcd )
```

BCD to decimal conversion.

##### Parameters

<i>bcd</i>	BCD encoded value.
------------	--------------------

##### Returns

Decimal value.

Definition at line 661 of file ErriezDS3231.cpp.

### 5.1.2.3 begin()

```
bool DS3231::begin ( )
```

Initialize and detect [DS3231](#) RTC.

Call this function from `setup()`.

#### Return values

<i>Success</i>	RTC detected.
<i>false</i>	RTC not detected.
<i>true</i>	Invalid status register or RTC not detected.

Definition at line 55 of file `ErriezDS3231.cpp`.

### 5.1.2.4 clearAlarmFlag()

```
void DS3231::clearAlarmFlag (
    AlarmId alarmId )
```

Clear alarm flag.

This function should be called when the alarm flag has been handled in polling and interrupt mode. The INT pin changes to high when both alarm flags are cleared and alarm interrupts are enabled.

#### Parameters

<i>alarmId</i>	Alarm1 or Alarm2 enum.
----------------	------------------------

#### Return values

<i>Success</i>	
<i>Failure</i>	Incorrect alarm ID.

Definition at line 478 of file `ErriezDS3231.cpp`.

### 5.1.2.5 decToBcd()

```
uint8_t DS3231::decToBcd (
    uint8_t dec )
```

Decimal to BCD conversion.

**Parameters**

<i>dec</i>	Decimal value.
------------	----------------

**Returns**

BCD encoded value.

Definition at line 673 of file ErriezDS3231.cpp.

**5.1.2.6 getAgingOffset()**

```
int8_t DS3231::getAgingOffset ( )
```

Get aging offset register.

The aging offset register capacitance value is added or subtracted from the capacitance value that the device calculates for each temperature compensation.

**Returns**

val Aging offset value.

Definition at line 586 of file ErriezDS3231.cpp.

**5.1.2.7 getAlarmFlag()**

```
bool DS3231::getAlarmFlag (
    AlarmId alarmId )
```

Get Alarm 1 or 2 flag.

Call this function to retrieve the alarm status flag. This function can be used in polling as well as with interrupts enabled.

The INT pin changes to low when an Alarm 1 or Alarm 2 match occurs and the interrupt is enabled. The pin remains low until both alarm flags are cleared by the application.

**Parameters**

<i>alarmId</i>	Alarm1 or Alarm2 enum.
----------------	------------------------

**Return values**

<i>true</i>	Alarm interrupt flag set.
-------------	---------------------------

## Return values

<i>false</i>	Alarm interrupt flag cleared.
--------------	-------------------------------

Definition at line 456 of file ErriezDS3231.cpp.

#### 5.1.2.8 getDateTime()

```
bool DS3231::getTime (
    DS3231_DateTime * dateTime )
```

Read date and time from RTC.

Read all RTC registers at once to prevent a time/date register change in the middle of the register read operation.

## Parameters

<i>dateTime</i>	Date and time structure.
-----------------	--------------------------

## Return values

<i>false</i>	Success
<i>true</i>	An invalid date/time format was read from the RTC.

Definition at line 176 of file ErriezDS3231.cpp.

#### 5.1.2.9 getEpochTime()

```
uint32_t DS3231::getEpochTime (
    DS3231_DateTime * dateTime )
```

Get Unix Epoch 32-bit timestamp in current timezone.

The [DS3231](#) RTC year range is valid between years 2000...2100. The time is in UTC.

## Return values

<i>epoch</i>	32-bit unsigned Unix Epoch time
--------------	---------------------------------

Definition at line 284 of file ErriezDS3231.cpp.



5.1.2.10 `getTemperature()`

```
void DS3231::getTemperature (
    int8_t * temperature,
    uint8_t * fraction )
```

Read temperature.

## Parameters

<i>temperature</i>	8-bit signed temperature in degree Celsius.
<i>fraction</i>	Temperature fraction in steps of 0.25 degree Celsius. The returned value is a decimal value to prevent floating point usage. The application should divided the fraction by 100.

Definition at line 633 of file `ErriezDS3231.cpp`.

5.1.2.11 `getTime()`

```
bool DS3231::getTime (
    uint8_t * hour,
    uint8_t * minute,
    uint8_t * second )
```

Read time from RTC.

Read hour, minute and second registers from RTC.

## Parameters

<i>hour</i>	Hours 0..23.
<i>minute</i>	Minutes 0..59.
<i>second</i>	Seconds 0..59.

## Return values

<i>false</i>	Success
<i>true</i>	Invalid second, minute or hour read from RTC. The time is set to zero.

Definition at line 246 of file `ErriezDS3231.cpp`.

5.1.2.12 `isOscillatorStopped()`

```
bool DS3231::isOscillatorStopped ( )
```

Read RTC OSF (Oscillator Stop Flag) from status register.

The application is responsible for checking the Oscillator Stop Flag (OSF) before reading date/time date. This function may be used to judge the validity of the date/time registers.

**Return values**

<i>true</i>	RTC oscillator was stopped: The date/time data is invalid. The application should synchronize and program a new date/time.
<i>false</i>	RTC oscillator is running.

Definition at line 104 of file ErriezDS3231.cpp.

**5.1.2.13 oscillatorEnable()**

```
void DS3231::oscillatorEnable (
    bool enable )
```

Enable or disable oscillator when running on V-BAT.

**Parameters**

<i>enable</i>	true: Enable RTC clock when running on V-BAT. false: Stop RTC clock when running on V-BAT. Oscillator Stop Flag (OSF) bit will be set in status register which can be read on next power-on.
---------------	---

Definition at line 73 of file ErriezDS3231.cpp.

**5.1.2.14 outputClockPinEnable()**

```
void DS3231::outputClockPinEnable (
    bool enable )
```

Enable or disable 32kHz output clock pin.

**Parameters**

<i>enable</i>	true: Enable 32kHz output clock pin. false: Disable 32kHz output clock pin.
---------------	--

Definition at line 531 of file ErriezDS3231.cpp.

**5.1.2.15 readBuffer()**

```
void DS3231::readBuffer (
    uint8_t reg,
```

```
void * buffer,  
uint8_t len )
```

Read buffer from RTC.

**Parameters**

<i>reg</i>	RTC register number 0x00..0x12.
<i>buffer</i>	Buffer.
<i>len</i>	Buffer length. Reading is only allowed within valid RTC registers.

Definition at line 780 of file ErriezDS3231.cpp.

**5.1.2.16 readControlRegister()**

```
uint8_t DS3231::readControlRegister ( )
```

Read control register.

**Returns**

8-bit unsigned register value

Definition at line 683 of file ErriezDS3231.cpp.

**5.1.2.17 readRegister()**

```
uint8_t DS3231::readRegister (
    uint8_t reg )
```

Read register.

Please refer to the RTC datasheet.

**Parameters**

<i>reg</i>	RTC register number 0x00..0x12.
------------	---------------------------------

**Returns**

value 8-bit unsigned register value.

Definition at line 724 of file ErriezDS3231.cpp.

**5.1.2.18 readStatusRegister()**

```
uint8_t DS3231::readStatusRegister ( )
```

Read status register.

**Returns**

8-bit unsigned register value

Definition at line 701 of file ErriezDS3231.cpp.

**5.1.2.19 setAgingOffset()**

```
void DS3231::setAgingOffset (
    int8_t val )
```

Set aging offset register.

The aging offset register capacitance value is added or subtracted from the capacitance value that the device calculates for each temperature compensation.

**Parameters**

<i>val</i>	Aging offset value -127..127, 0.1ppm per LSB (Factory default value: 0). Negative values increases the RTC oscillator frequency.
------------	---

Definition at line 558 of file ErriezDS3231.cpp.

**5.1.2.20 setAlarm1()**

```
void DS3231::setAlarm1 (
    Alarm1Type alarmType,
    uint8_t dayDate,
    uint8_t hours,
    uint8_t minutes,
    uint8_t seconds )
```

Set Alarm 1.

Alarm 1 contains several alarm modes which can be configured with the alarmType parameter. Unused matches can be set to zero. The alarm interrupt must be enabled after setting the alarm, followed by clearing the alarm interrupt flag.

**Parameters**

<i>alarmType</i>	Alarm 1 types: Alarm1EverySecond Alarm1MatchSeconds Alarm1MatchMinutes Alarm1MatchHours Alarm1MatchDay Alarm1MatchDate
<i>dayDate</i>	Alarm match day of the week or day of the month. This depends on alarmType.
<i>hours</i>	Alarm match hours.
<i>minutes</i>	Alarm match minutes.
<i>seconds</i>	Alarm match seconds.

Definition at line 339 of file ErriezDS3231.cpp.

#### 5.1.2.21 setAlarm2()

```
void DS3231::setAlarm2 (
    Alarm2Type alarmType,
    uint8_t dayDate,
    uint8_t hours,
    uint8_t minutes )
```

Set Alarm 2.

Alarm 2 contains different alarm modes which can be configured with the alarmType parameter. Unused matches can be set to zero. The alarm interrupt must be enabled after setting the alarm, followed by clearing the alarm interrupt flag.

##### Parameters

<i>alarmType</i>	Alarm 2 types: Alarm2EveryMinute Alarm2MatchMinutes Alarm2MatchHours Alarm2MatchDay Alarm2MatchDate
<i>dayDate</i>	Alarm match day of the week or day of the month. This depends on alarmType.
<i>hours</i>	Alarm match hours.
<i>minutes</i>	Alarm match minutes.

Definition at line 384 of file ErriezDS3231.cpp.

#### 5.1.2.22 setDateTime()

```
void DS3231::setDateTime (
    DS3231_DateTime * dateTime )
```

Write date and time to RTC.

Write all RTC registers at once to prevent a time/date register change in the middle of the register write operation. This function enables the oscillator and clear the Oscillator Stop Flag (OSF) in the status register.

##### Parameters

<i>dateTime</i>	Date time structure. Providing invalid date/time data may result in unpredictable behavior.
-----------------	---

Definition at line 141 of file ErriezDS3231.cpp.

## 5.1.2.23 setSquareWave()

```
void DS3231::setSquareWave (
    SquareWave squareWave )
```

Configure SQW (Square Wave) output pin.

This will disable or initialize the SQW clock pin. The alarm interrupt INT pin will be disabled.

## Parameters

<i>squareWave</i>	SquareWave configuration: Disable: SquareWaveDisable 1Hz: SquareWave1Hz 1024Hz: SquareWave1024Hz 4096Hz: SquareWave4096Hz 8192Hz: SquareWave8192Hz
-------------------	---

## Return values

<i>Success</i>	
<i>Failure</i>	Incorrect squareWave.

Definition at line 509 of file ErriezDS3231.cpp.

## 5.1.2.24 setTime()

```
void DS3231::setTime (
    uint8_t hour,
    uint8_t minute,
    uint8_t second )
```

Write time to RTC.

Read all date/time register from RTC, update time registers and write all date/time registers to the RTC with one write operation.

## Parameters

<i>hour</i>	Hours 0..23.
<i>minute</i>	Minutes 0..59.
<i>second</i>	Seconds 0..59.

Definition at line 218 of file ErriezDS3231.cpp.

## 5.1.2.25 startTemperatureConversion()

```
void DS3231::startTemperatureConversion ( )
```

Start temperature conversion.

Starting a conversion is only needed when the application requires temperature reads within 64 seconds, or changing the aging offset register.

Definition at line 609 of file ErriezDS3231.cpp.

#### 5.1.2.26 writeBuffer()

```
void DS3231::writeBuffer (
    uint8_t reg,
    void * buffer,
    uint8_t len )
```

Write buffer to RTC.

Please refer to the RTC datasheet.

##### Parameters

<i>reg</i>	RTC register number 0x00..0x12.
<i>buffer</i>	Buffer.
<i>len</i>	Buffer length. Writing is only allowed within valid RTC registers.

Definition at line 760 of file ErriezDS3231.cpp.

#### 5.1.2.27 writeControlRegister()

```
void DS3231::writeControlRegister (
    uint8_t value )
```

Write control register.

##### Parameters

<i>value</i>	8-bit unsigned register value
--------------	-------------------------------

Definition at line 692 of file ErriezDS3231.cpp.

#### 5.1.2.28 writeRegister()

```
void DS3231::writeRegister (
    uint8_t reg,
    uint8_t value )
```



Write to RTC register.

Please refer to the RTC datasheet.

#### Parameters

<i>reg</i>	RTC register number 0x00..0x12.
<i>value</i>	8-bit unsigned register value.

Definition at line 743 of file ErriezDS3231.cpp.

#### 5.1.2.29 writeStatusRegister()

```
void DS3231::writeStatusRegister (
    uint8_t value )
```

Write status register.

#### Parameters

<i>value</i>	8-bit unsigned register value
--------------	-------------------------------

Definition at line 710 of file ErriezDS3231.cpp.

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

- src/[ErriezDS3231.h](#)
- src/[ErriezDS3231.cpp](#)

## 5.2 DS3231\_DateTime\_s Struct Reference

Date time structure.

```
#include <ErriezDS3231.h>
```

#### Public Attributes

- `uint8_t second`  
*Second 0..59.*
- `uint8_t minute`  
*Minute 0..59.*
- `uint8_t hour`  
*Hour 0..23.*
- `uint8_t dayWeek`  
*Day of the week (1 = Monday)*
- `uint8_t dayMonth`  
*Day of the month 1..31.*
- `uint8_t month`  
*Month 1..12.*
- `uint16_t year`  
*Year 2000..2099.*

### 5.2.1 Detailed Description

Date time structure.

Definition at line 103 of file ErriezDS3231.h.

The documentation for this struct was generated from the following file:

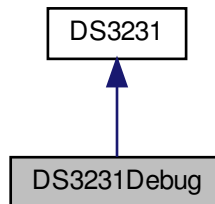
- [src/ErriezDS3231.h](#)

## 5.3 DS3231Debug Class Reference

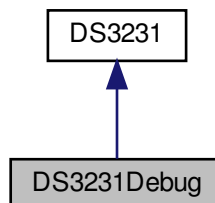
[DS3231](#) RTC debug class.

```
#include <ErriezDS3231_debug.h>
```

Inheritance diagram for DS3231Debug:



Collaboration diagram for DS3231Debug:



## Public Member Functions

- virtual void [dumpRegisters](#) (Stream \*ser, bool printBitFields=true)  
*Dump all registers to serial port.*
- virtual void [printRegister](#) (Stream \*ser, uint8\_t reg, bool printBitFields=true)  
*Print register and value.*
- virtual void [printRegisterBitFields](#) (Stream \*ser, uint8\_t reg, uint8\_t regVal)  
*Print register bitfields.*
- virtual void [printDiagnostics](#) (Stream \*ser)  
*Print diagnostics.*

### 5.3.1 Detailed Description

[DS3231](#) RTC debug class.

The output will be redirected to a user defined serial port. This class can be used by advanced developers to print internal RTC registers and diagnostics. Keep in mind that all strings used in this class are flash consuming.

Definition at line 48 of file `ErriezDS3231_debug.h`.

### 5.3.2 Member Function Documentation

#### 5.3.2.1 dumpRegisters()

```
void DS3231Debug::dumpRegisters (
    Stream * ser,
    bool printBitFields = true ) [virtual]
```

Dump all registers to serial port.

#### Parameters

<i>ser</i>	Serial port.
<i>printBitFields</i>	true: Print register bitfields.

Definition at line 76 of file `ErriezDS3231_debug.cpp`.

#### 5.3.2.2 printDiagnostics()

```
void DS3231Debug::printDiagnostics (
    Stream * ser ) [virtual]
```

Print diagnostics.

**Parameters**

<i>ser</i>	Serial port.
------------	--------------

Definition at line 290 of file ErriezDS3231\_debug.cpp.

**5.3.2.3 printRegister()**

```
void DS3231Debug::printRegister (
    Stream * ser,
    uint8_t reg,
    bool printBitFields = true ) [virtual]
```

Print register and value.

**Parameters**

<i>ser</i>	Serial port.
<i>reg</i>	Register number.
<i>printBitFields</i>	true: Print register bitfields.

Definition at line 93 of file ErriezDS3231\_debug.cpp.

**5.3.2.4 printRegisterBitFields()**

```
void DS3231Debug::printRegisterBitFields (
    Stream * ser,
    uint8_t reg,
    uint8_t regVal ) [virtual]
```

Print register bitfields.

**Parameters**

<i>ser</i>	Serial port.
<i>reg</i>	Register number.
<i>regVal</i>	Register value.

Definition at line 120 of file ErriezDS3231\_debug.cpp.

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

- [src/ErriezDS3231\\_debug.h](#)
- [src/ErriezDS3231\\_debug.cpp](#)

## Chapter 6

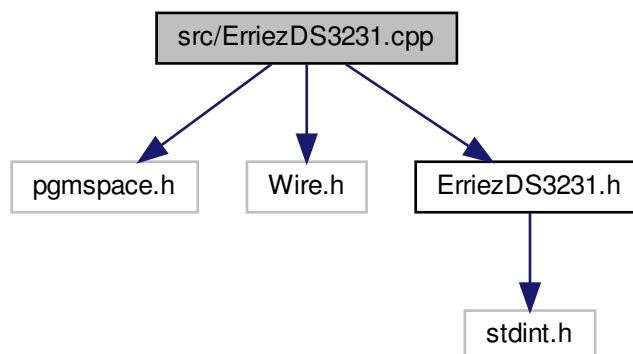
# File Documentation

### 6.1 src/ErriezDS3231.cpp File Reference

**DS3231** high precision RTC library for Arduino.

```
#include <pgmspace.h>
#include <Wire.h>
#include "ErriezDS3231.h"
```

Include dependency graph for ErriezDS3231.cpp:



#### Variables

- `const uint8_t daysMonth [12] PROGMEM = {31, 28, 31, 30, 31, 30, 31, 31, 30, 31, 30, 31}`  
*Define number of days in a month once in flash.*

#### 6.1.1 Detailed Description

**DS3231** high precision RTC library for Arduino.

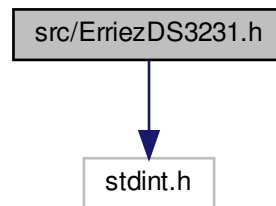
Source: <https://github.com/Erriez/ErriezDS3231> Documentation: <https://erriez.github.io/ErriezDS3231>

## 6.2 src/ErriezDS3231.h File Reference

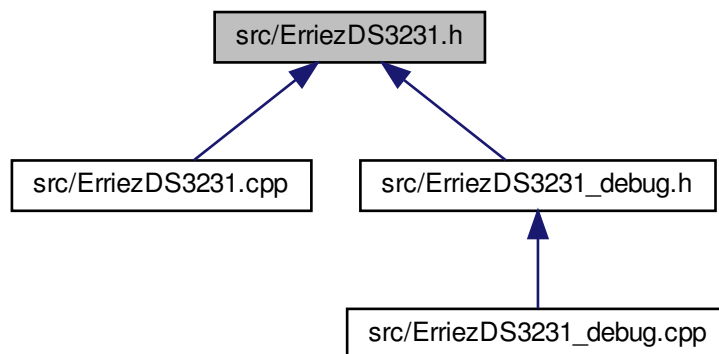
[DS3231](#) high precision RTC library for Arduino.

```
#include <stdint.h>
```

Include dependency graph for ErriezDS3231.h:



This graph shows which files directly or indirectly include this file:



### Classes

- struct [DS3231\\_DateTime\\_s](#)  
*Date time structure.*
- class [DS3231](#)  
*DS3231 RTC base class.*

## Macros

- #define DS3231\_REG\_SECONDS 0x00  
*DS3231 registers.*
- #define DS3231\_REG\_MINUTES 0x01  
*Minutes register.*
- #define DS3231\_REG\_HOURS 0x02  
*Hours register.*
- #define DS3231\_REG\_DAY\_WEEK 0x03  
*Day of the week register.*
- #define DS3231\_REG\_DAY\_MONTH 0x04  
*Day of the month register.*
- #define DS3231\_REG\_MONTH 0x05  
*Month register.*
- #define DS3231\_REG\_YEAR 0x06  
*Year register.*
- #define DS3231\_REG\_ALARM1\_SEC 0x07  
*Alarm 1 seconds register.*
- #define DS3231\_REG\_ALARM1\_MIN 0x08  
*Alarm 1 minutes register.*
- #define DS3231\_REG\_ALARM1\_HOUR 0x09  
*Alarm 1 hour register.*
- #define DS3231\_REG\_ALARM1\_DD 0x0A  
*Alarm 1 day/date register.*
- #define DS3231\_REG\_ALARM2\_MIN 0x0B  
*Alarm 2 seconds register.*
- #define DS3231\_REG\_ALARM2\_HOUR 0x0C  
*Alarm 2 hour register.*
- #define DS3231\_REG\_ALARM2\_DD 0x0D  
*Alarm 2 day/date register.*
- #define DS3231\_REG\_CONTROL 0x0E  
*Control register.*
- #define DS3231\_REG\_STATUS 0x0F  
*Status register.*
- #define DS3231\_REG\_AGING\_OFFSET 0x10  
*Aging offset register.*
- #define DS3231\_REG\_TEMP\_MSB 0x11  
*Temperature MSB register.*
- #define DS3231\_REG\_TEMP\_LSB 0x12  
*Temperature LSB register.*
- #define DS3231\_NUM\_REGS 19  
*DS3231 number of registers.*
- #define DS3231\_HOUR\_12H\_24H 6  
*DS3231 register bit defines.*
- #define DS3231\_HOUR\_AM\_PM 5  
*AM/PM.*
- #define DS3231\_MONTH\_CENTURY 7  
*Century.*
- #define DS3231\_CTRL\_EOSC 7  
*Enable oscillator.*
- #define DS3231\_CTRL\_BBSQW 6

- *Battery-Backed Square-Wave Enable.*
- #define [DS3231\\_CTRL\\_CONV](#) 5  
*Start temperature conversion.*
- #define [DS3231\\_CTRL\\_RS2](#) 4  
*Square wave rate-select 2.*
- #define [DS3231\\_CTRL\\_RS1](#) 3  
*Square wave rate-select 1.*
- #define [DS3231\\_CTRL\\_INTCN](#) 2  
*Interrupt control.*
- #define [DS3231\\_CTRL\\_A2IE](#) 1  
*Alarm 2 interrupt enable.*
- #define [DS3231\\_CTRL\\_A1IE](#) 0  
*Alarm 1 interrupt enable.*
- #define [DS3231\\_STAT\\_OSF](#) 7  
*Oscillator Stop Flag.*
- #define [DS3231\\_STAT\\_EN32KHZ](#) 3  
*Enable 32kHz clock output.*
- #define [DS3231\\_STAT\\_BSY](#) 2  
*Temperature conversion busy flag.*
- #define [DS3231\\_STAT\\_A2F](#) 1  
*Alarm 2 status flag.*
- #define [DS3231\\_STAT\\_A1F](#) 0  
*Alarm 1 status flag.*
- #define [DS3231\\_A1M1](#) 7  
*Alarm 1 bit 7 seconds register.*
- #define [DS3231\\_A1M2](#) 7  
*Alarm 1 bit 7 minutes register.*
- #define [DS3231\\_A1M3](#) 7  
*Alarm 1 bit 7 hours register.*
- #define [DS3231\\_A1M4](#) 7  
*Alarm 1 bit 7 day/date register.*
- #define [DS3231\\_A2M2](#) 7  
*Alarm 2 bit 7 minutes register.*
- #define [DS3231\\_A2M3](#) 7  
*Alarm 2 bit 7 hours register.*
- #define [DS3231\\_A2M4](#) 7  
*Alarm 2 bit 7 day/date register.*
- #define [DS3231\\_DYDT](#) 6  
*Alarm 2 bit 6.*
- #define [DS3231\\_ADDR](#) (0xD0 >> 1)  
*DS3231 I2C 7-bit address.*
- #define [SECONDS\\_FROM\\_1970\\_TO\\_2000](#) 946684800  
*Number of seconds between year 1970 and 2000.*

## Typedefs

- typedef struct [DS3231\\_DateTime\\_s](#) [DS3231\\_DateTime](#)  
*Date time structure.*



## Enumerations

- enum [AlarmId](#) { [Alarm1](#) = 1, [Alarm2](#) = 2 }  
*Alarm ID.*
- enum [Alarm1Type](#) {  
[Alarm1EverySecond](#) = 0x0F, [Alarm1MatchSeconds](#) = 0x0E, [Alarm1MatchMinutes](#) = 0x0C, [Alarm1MatchHours](#) = 0x08,  
[Alarm1MatchDay](#) = 0x10, [Alarm1MatchDate](#) = 0x00 }  
*Alarm 1 types enum.*
- enum [Alarm2Type](#) {  
[Alarm2EveryMinute](#) = 0x0E, [Alarm2MatchMinutes](#) = 0x0C, [Alarm2MatchHours](#) = 0x08, [Alarm2MatchDay](#) = 0x10,  
[Alarm2MatchDate](#) = 0x00 }  
*Alarm 2 types enum.*
- enum [SquareWave](#) {  
[SquareWaveDisable](#) = (1 << DS3231\_CTRL\_INTCN), [SquareWave1Hz](#) = ((0 << DS3231\_CTRL\_RS2) | (0 << DS3231\_CTRL\_RS1)), [SquareWave1024Hz](#) = ((0 << DS3231\_CTRL\_RS2) | (1 << DS3231\_CTRL\_RS1)), [SquareWave4096Hz](#) = ((1 << DS3231\_CTRL\_RS2) | (0 << DS3231\_CTRL\_RS1)), [SquareWave8192Hz](#) = ((1 << DS3231\_CTRL\_RS2) | (1 << DS3231\_CTRL\_RS1)) }  
*Squarewave enum.*

### 6.2.1 Detailed Description

[DS3231](#) high precision RTC library for Arduino.

Source: <https://github.com/Erriez/ErriezDS3231> Documentation: <https://erriez.github.io/ErriezDS3231>

### 6.2.2 Macro Definition Documentation

#### 6.2.2.1 DS3231\_HOUR\_12H\_24H

```
#define DS3231_HOUR_12H_24H 6
```

[DS3231](#) register bit defines.

12 or 24 hour mode

Definition at line 65 of file [ErriezDS3231.h](#).

#### 6.2.2.2 DS3231\_NUM\_REGS

```
#define DS3231_NUM_REGS 19
```

[DS3231](#) number of registers.

19 RTC register: 0x00..0x12

Definition at line 62 of file [ErriezDS3231.h](#).

### 6.2.2.3 DS3231\_REG\_SECONDS

```
#define DS3231_REG_SECONDS 0x00
```

DS3231 registers.

Seconds register

Definition at line 39 of file ErriezDS3231.h.

## 6.2.3 Enumeration Type Documentation

### 6.2.3.1 Alarm1Type

```
enum Alarm1Type
```

Alarm 1 types enum.

Enumerator

Alarm1EverySecond	Alarm once per second.
Alarm1MatchSeconds	Alarm when seconds match.
Alarm1MatchMinutes	Alarm when minutes and seconds match.
Alarm1MatchHours	Alarm when hours, minutes, and seconds match.
Alarm1MatchDay	Alarm when date, hours, minutes, and seconds match.
Alarm1MatchDate	Alarm when day, hours, minutes, and seconds match.

Definition at line 124 of file ErriezDS3231.h.

### 6.2.3.2 Alarm2Type

```
enum Alarm2Type
```

Alarm 2 types enum.

Enumerator

Alarm2EveryMinute	Alarm once per minute (00 seconds of every minute)
Alarm2MatchMinutes	Alarm when minutes match.
Alarm2MatchHours	Alarm when hours and minutes match.
Alarm2MatchDay	Alarm when date, hours, and minutes match.
Alarm2MatchDate	Alarm when day, hours, and minutes match.

Definition at line 137 of file ErriezDS3231.h.

### 6.2.3.3 AlarmId

enum [AlarmId](#)

Alarm ID.

Enumerator

Alarm1	Alarm ID 1.
Alarm2	Alarm ID 2.

Definition at line 116 of file ErriezDS3231.h.

### 6.2.3.4 SquareWave

enum [SquareWave](#)

Squarewave enum.

Enumerator

SquareWaveDisable	SQW disable.
SquareWave1Hz	SQW 1Hz.
SquareWave1024Hz	SQW 1024Hz.
SquareWave4096Hz	SQW 4096Hz.
SquareWave8192Hz	SQW 8192Hz.

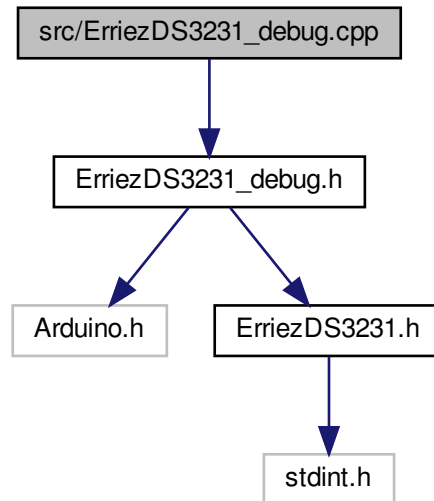
Definition at line 149 of file ErriezDS3231.h.

## 6.3 src/ErriezDS3231\_debug.cpp File Reference

[DS3231](#) high precision RTC debug library for Arduino.

```
#include "ErriezDS3231_debug.h"
```

Include dependency graph for ErriezDS3231\_debug.cpp:



## Variables

- `const char reg_0x00 [] PROGMEM = "Seconds"`  
*Register names as string in flash.*

### 6.3.1 Detailed Description

**DS3231** high precision RTC debug library for Arduino.

Source: <https://github.com/Erriez/ErriezDS3231> Documentation: <https://erriez.github.io/ErriezDS3231>

### 6.3.2 Variable Documentation

#### 6.3.2.1 PROGMEM

```
const char* const registerNames [] PROGMEM = "Seconds"
```

Register names as string in flash.

Array with all register names in flash.

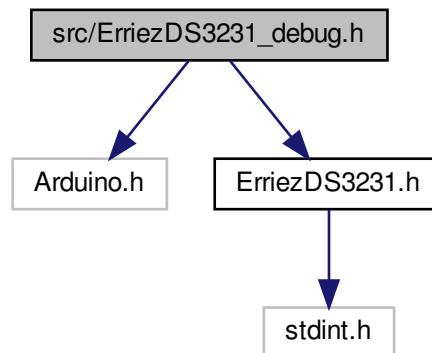
Definition at line 38 of file `ErriezDS3231_debug.cpp`.

## 6.4 src/ErriezDS3231\_debug.h File Reference

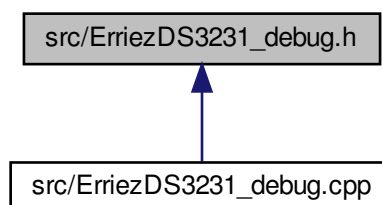
**DS3231** high precision RTC debug library for Arduino.

```
#include <Arduino.h>
#include "ErriezDS3231.h"
```

Include dependency graph for ErriezDS3231\_debug.h:



This graph shows which files directly or indirectly include this file:



### Classes

- class **DS3231Debug**  
*DS3231 RTC debug class.*

### 6.4.1 Detailed Description

**DS3231** high precision RTC debug library for Arduino.

Source: <https://github.com/Erriez/ErriezDS3231> Documentation: <https://erriez.github.io/ErriezDS3231>



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