Erriez DS3231 high precision I2C RTC library for Arduino

2.0.0

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Contents

Chapter 1

DS3231 high precision I2C RTC library for Arduino

This is a DS3231 high precision I2C RTC library for Arduino.

Library features

- Set / get time
- Set date / time with `struct tm`
- Set / get Unix Epoch UTC 32-bit timestamp `time_t`
- Day of the week calculation
- 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
- Set date/time over serial with Python script

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` 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 - DS3231	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.
- `DateStrings` Date strings in flash example.
- `Read` Simple RTC read example.
- `ReadTimeInterrupt` Read time with 1Hz SQW interrupt. (Highly recommended)
- `SetDateTime` Set date time. (Must be started first)
- `Temperature` Temperature.
- `Terminal` Advanced terminal interface with `set date/time Python` script.
- `Test` Regression test.

Documentation

- Doxygen online HTML
- Doxygen PDF
- DS3231 datasheet

Usage

Initialization

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

// Create DS3231 RTC object
DS3231 rtc;

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

    // Initialize RTC
    while (!ds3231.begin()) {
        // Error: Could not detect DS3231 RTC, retry after some time
        delay(3000);
    }
}
```

Check oscillator status at startup

```
{c++}
// Check oscillator status
if (ds3231.isOscillatorStopped()) {
    // Error: DS3231 RTC oscillator stopped. Date/time cannot be trusted.
    // Set new date/time before reading date/time.

    // Start oscillator with date/time "Sun Jan 1 2000 0:00:00"
    ds3231.oscillatorEnable(true);
}
```

Set time

```
{c++}
// Write time to RTC
if (!ds3231.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 (!ds3231.getTime(&hour, &minute, &second)) {
    // Error: Read time failed
}
```

Set date time

```
{c++}
// Create and initialize date time object
struct tm dt;

dt.tm_sec = 0,      // Seconds 0..59
dt.tm_min = 36,     // Minutes 0..59
dt.tm_hour = 21,    // Hours 0..23
dt.tm_wday = 6;     // Day of the week: 0 = Sunday .. 6=Saturday
dt.tm_mday = 29;    // Day of the month 1..31
dt.tm_mon = 7;      // Month 0..11
dt.tm_year = 2020-1900; // Year starting at 1900

// Write date/time to RTC
if (!ds3231.write(&dt)) {
    // Error: Write date/time failed
}
```

Get date time

```
{c++}
struct tm dt;

// Read date/time from RTC
if (!ds3231.read(&dt)) {
    // Error: Read date/time failed
}
```

Get Epoch Unix UTC time

```
{c++}
// Get Unix epoch UTC time
time_t t = ds3231.getEpoch();
```

Get temperature

```
{c++}
int8_t temperature = 0;
uint8_t fraction = 0;

// Force temperature conversion
// Without this call, it takes 64 seconds before the temperature is updated.
if (!ds3231.startTemperatureConversion()) {
    // Error: Start temperature conversion failed
}

// Read temperature
if (!ds3231.getTemperature(&temperature, &fraction)) {
    // Error: Get temperature failed
}

// 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
ds3231.setAlarm1(Alarm1EverySecond, 0, 0, 0, 0);

// Generate alarm 1 every minute and second match
ds3231.setAlarm1(Alarm1EverySecond, 0, 0, 45, 30);

// Generate alarm 1 every day, hour, minute and second match
ds3231.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
ds3231.setAlarm2(Alarm2EveryMinute, 0, 0, 0);

// Generate alarm 2 every hour, minute match
ds3231.setAlarm2(Alarm2MatchHours, 0, 23, 59);

// Generate alarm 2 every date, hour, minute match
ds3231.setAlarm2(Alarm2MatchDate, 28, 7, 0);
```

Alarm polling

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

```
{c++}
// Poll alarm 1 flag
if (ds3231.getAlarmFlag(Alarm1)) {
    // Handle Alarm 1

    // Clear alarm 1 flag
    ds3231.clearAlarmFlag(Alarm1);
}

// Poll alarm 2 flag
if (ds3231.getAlarmFlag(Alarm2)) {
    // Handle Alarm 2

    // Clear alarm 2 flag
    ds3231.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
volatile bool alarmInterrupt = false;


#if defined(ARDUINO_ARCH_ESP8266) || defined(ARDUINO_ARCH_ESP32)
ICACHE_RAM_ATTR
#endif
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
    ds3231.alarmInterruptEnable(Alarm1, true);
    ds3231.alarmInterruptEnable(Alarm2, true);
}

void loop()
{
    // Check global alarm interrupt flag
    if (alarmInterrupt) {
        if (ds3231.getAlarmFlag(Alarm1)) {
            // Handle alarm 1

            // Clear alarm 1 interrupt
```

```
            ds3231.clearAlarmFlag(Alarm1);
        }

        if (ds3231.getAlarmFlag(Alarm2)) {
            // Handle alarm 2

            // Clear alarm 2 interrupt
            ds3231.clearAlarmFlag(Alarm2);
        }
    }
}
```

32kHz clock out

Enable or disable `32kHz` output pin.

```
{c++}
ds3231.outputClockPinEnable(true);  // Enable
ds3231.outputClockPinEnable(false); // Disable
```

Square Wave Out (SQW)

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

```
{c++}
ds3231.setSquareWave(SquareWaveDisable);    // Disable
ds3231.setSquareWave(SquareWave1Hz);        // 1Hz
ds3231.setSquareWave(SquareWave1024Hz); // 1024Hz
ds3231.setSquareWave(SquareWave4096Hz); // 4096Hz
ds3231.setSquareWave(SquareWave8192Hz); // 8192Hz
```

API changes v1.0.1 to v2.0.0

The API has been changed to make RTC libraries compatible with libc `time.h`. This makes it easier to calculate with date/time and port the application to different platforms. See changes below:

v1.0.1	v2.0.0
`DS3231_DateTime`	`struct tm`
Function returns `true`: failure	Function returns `false`: failure
	`clearOscillatorStopFlag()` merged into `oscillator↩ Enable()`
`setDateTime()`	`bool write(struct tm *dt)`
`getDateTime()`	`bool read(struct tm *dt)`
`getEpochTime()`	`time_t getEpoch()`
	`bool setEpoch(time_t t)`
	`bool setDateTime(uint8_t hour, uint8_t min, uint8↩ _t sec, uint8_t mday, uint8_t mon, uint16_t year, uint8_t wday)`
	`ErriezDS3231Debug` class removed to reduce flash size

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

Class Index

2.1 Class List

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

Chapter 3

File Index

3.1 File List

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

Chapter 4

Class Documentation

4.1 ErriezDS3231 Class Reference

DS3231 RTC base class.

`#include <ErriezDS3231.h>`

Public Member Functions

- bool begin ()

  Initialize and detect DS3231 RTC.
- bool oscillatorEnable (bool enable)

  Enable or disable oscillator when running on V-BAT.
- bool isOscillatorStopped ()

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

  Read Unix UTC epoch time_t.
- bool setEpoch (time_t t)

  Write Unix epoch UTC time to RTC.
- bool read (struct tm *dt)

  Read date and time from RTC.
- bool write (const struct tm *dt)

  Write date and time to RTC.
- bool setTime (uint8_t hour, uint8_t min, uint8_t sec)

  Write time to RTC.
- bool getTime (uint8_t *hour, uint8_t *min, uint8_t *sec)

  Read time from RTC.
- bool setDateTime (uint8_t hour, uint8_t min, uint8_t sec, uint8_t mday, uint8_t mon, uint16_t year, uint8_t wday)

  Set date time.
- bool setAlarm1 (Alarm1Type alarmType, uint8_t dayDate, uint8_t hours, uint8_t minutes, uint8_t seconds)

  Set Alarm 1.
- bool setAlarm2 (Alarm2Type alarmType, uint8_t dayDate, uint8_t hours, uint8_t minutes)

  Set Alarm 2.
- bool alarmInterruptEnable (AlarmId alarmId, bool enable)

Enable or disable Alarm 1 or 2 interrupt.

- bool getAlarmFlag (AlarmId alarmId)

  Get Alarm 1 or 2 flag.
- bool clearAlarmFlag (AlarmId alarmId)

  Clear alarm flag.
- bool setSquareWave (SquareWave squareWave)

  Configure SQW (Square Wave) output pin.
- bool outputClockPinEnable (bool enable)

  Enable or disable 32kHz output clock pin.
- bool setAgingOffset (int8_t val)

  Set aging offset register.
- int8_t getAgingOffset ()

  Get aging offset register.
- bool startTemperatureConversion ()

  Start temperature conversion.
- bool 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 readRegister (uint8_t reg)

  Read register.
- bool writeRegister (uint8_t reg, uint8_t value)

  Write to RTC register.
- bool readBuffer (uint8_t reg, void ∗buffer, uint8_t len)

  Read buffer from RTC.
- bool writeBuffer (uint8_t reg, void ∗buffer, uint8_t len)

  Write buffer to RTC.

4.1.1 Detailed Description

DS3231 RTC base class.

Definition at line 149 of file ErriezDS3231.h.

4.1.2 Member Function Documentation

4.1.2.1 alarmInterruptEnable()

```
bool ErriezDS3231::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

alarm↩ Id	Alarm1 or Alarm2 enum.
enable	true: Enable alarm interrupt. false: Disable alarm interrupt.

Return values

true	Success
false	Alarm interrupt enable failed.

Definition at line 465 of file ErriezDS3231.cpp.

4.1.2.2 bcdToDec()

```
uint8_t ErriezDS3231::bcdToDec (
            uint8_t bcd )
```

BCD to decimal conversion.

Parameters

bcd	BCD encoded value.

Returns

Decimal value.

Definition at line 733 of file ErriezDS3231.cpp.

4.1.2.3 begin()

```
bool ErriezDS3231::begin ( )
```

Initialize and detect DS3231 RTC.

Return values

true	RTC detected.
false	RTC not detected.

Definition at line 50 of file ErriezDS3231.cpp.

4.1.2.4 clearAlarmFlag()

```
bool ErriezDS3231::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

alarmId	Alarm1 or Alarm2 enum.

Return values

true	Success
false	Incorrect alarm ID.

Definition at line 527 of file ErriezDS3231.cpp.

4.1.2.5 decToBcd()

```
uint8_t ErriezDS3231::decToBcd (
            uint8_t dec )
```

Decimal to BCD conversion.

Parameters

dec	Decimal value.

Returns

BCD encoded value.

Definition at line 745 of file ErriezDS3231.cpp.

4.1.2.6 getAgingOffset()

```
int8_t ErriezDS3231::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 646 of file ErriezDS3231.cpp.

4.1.2.7 getAlarmFlag()

```
bool ErriezDS3231::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

alarmId	Alarm1 or Alarm2 enum.

Return values

true	Alarm interrupt flag set.
false	Alarm interrupt flag cleared.

Definition at line 504 of file ErriezDS3231.cpp.

4.1.2.8 getEpoch()

```
time_t ErriezDS3231::getEpoch ( )
```

Read Unix UTC epoch time_t.

Returns

Unix epoch time_t seconds since 1970.

Definition at line 124 of file ErriezDS3231.cpp.

4.1.2.9 getTemperature()

```
bool ErriezDS3231::getTemperature (
            int8_t * temperature,
            uint8_t * fraction )
```

Read temperature.

Parameters

temperature	8-bit signed temperature in degree Celsius.
fraction	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.

Return values

true	Success
false	Set get temperature failed.

Definition at line 701 of file ErriezDS3231.cpp.

4.1.2.10 getTime()

```
bool ErriezDS3231::getTime (
            uint8_t * hour,
            uint8_t * min,
            uint8_t * sec )
```

Read time from RTC.

Read hour, minute and second registers from RTC.

Parameters

hour	Hours 0..23.
min	Minutes 0..59.
sec	Seconds 0..59.

Return values

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

Definition at line 281 of file ErriezDS3231.cpp.

4.1.2.11 isOscillatorStopped()

```
bool ErriezDS3231::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

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

Definition at line 107 of file ErriezDS3231.cpp.

4.1.2.12 oscillatorEnable()

```
bool ErriezDS3231::oscillatorEnable (
            bool enable )
```

Enable or disable oscillator when running on V-BAT.

Parameters

enable	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.

Return values

true	Success.
false	Oscillator enable failed.

Definition at line 71 of file ErriezDS3231.cpp.

4.1.2.13 outputClockPinEnable()

```
bool ErriezDS3231::outputClockPinEnable (
            bool enable )
```

Enable or disable 32kHz output clock pin.

Parameters

enable	true: Enable 32kHz output clock pin. false: Disable 32kHz output clock pin.

Return values

true	Success
false	Set output clock pin failed.

Definition at line 585 of file ErriezDS3231.cpp.

4.1.2.14 read()

```
bool ErriezDS3231::read (
            struct tm * dt )
```

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

dt	Date and time struct tm.

Return values

true	Success
false	RTC read failed.

Definition at line 182 of file ErriezDS3231.cpp.

4.1.2.15 readBuffer()

```
bool ErriezDS3231::readBuffer (
            uint8_t reg,
            void * buffer,
            uint8_t len )
```

Read buffer from RTC.

Parameters

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

Return values

true	Success
false	I2C read failed.

Definition at line 829 of file ErriezDS3231.cpp.

4.1.2.16 readRegister()

```
uint8_t ErriezDS3231::readRegister (
            uint8_t reg )
```

Read register.

Please refer to the RTC datasheet.

Parameters

reg	RTC register number 0x00..0x12.

Returns

value 8-bit unsigned register value.

Definition at line 761 of file ErriezDS3231.cpp.

4.1.2.17 setAgingOffset()

```
bool ErriezDS3231::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

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

Return values

true	Success
false	Set aging offset failed.

Definition at line 616 of file ErriezDS3231.cpp.

4.1.2.18 setAlarm1()

```
bool ErriezDS3231::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

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

Return values

true	Success.
false	Set alarm 1 failed.

Definition at line 375 of file ErriezDS3231.cpp.

4.1.2.19 setAlarm2()

```
bool ErriezDS3231::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

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

Return values

true	Success.
false	Set alarm 2 failed.

Definition at line 426 of file ErriezDS3231.cpp.

4.1.2.20 setDateTime()

```
bool ErriezDS3231::setDateTime (
            uint8_t hour,
            uint8_t min,
            uint8_t sec,
            uint8_t mday,
            uint8_t mon,
            uint16_t year,
            uint8_t wday )
```

Set date time.

Parameters

hour	Hours 0..23
min	Minutes 0..59
sec	Seconds 0..59
mday	Day of the month 1..31
mon	Month 1..12 (1=January)
year	Year 2000..2099
wday	Day of the week 0..6 (0=Sunday, .. 6=Sunday)

Return values

true	Success.
false	Set time failed.

Definition at line 329 of file ErriezDS3231.cpp.

4.1.2.21 setEpoch()

```
bool ErriezDS3231::setEpoch (
            time_t t )
```

Write Unix epoch UTC time to RTC.

Parameters

t	time_t time

Returns

See write returns.

Definition at line 154 of file ErriezDS3231.cpp.

4.1.2.22 setSquareWave()

```
bool ErriezDS3231::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

squareWave	SquareWave configuration: Disable: SquareWaveDisable 1Hz: SquareWave1Hz 1024Hz: SquareWave1024Hz 4096Hz: SquareWave4096Hz 8192Hz: SquareWave8192Hz

Return values

true	Success
false	Set squareWave failed.

Definition at line 559 of file ErriezDS3231.cpp.

4.1.2.23 setTime()

```
bool ErriezDS3231::setTime (
            uint8_t hour,
            uint8_t min,
            uint8_t sec )
```

Write time to RTC.

Write hour, minute and second registers to RTC.

Parameters

hour	Hours 0..23.
min	Minutes 0..59.
sec	Seconds 0..59.

Return values

true	Success.
false	Set time failed.

Definition at line 253 of file ErriezDS3231.cpp.

4.1.2.24 startTemperatureConversion()

```
bool ErriezDS3231::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.

Return values

true	Success
false	Start temperature conversion failed.

Definition at line 673 of file ErriezDS3231.cpp.

4.1.2.25 write()

```
bool ErriezDS3231::write (
            const struct tm * dt )
```

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

dateTime	Date time structure. Providing invalid date/time data may result in unpredictable behavior.

Definition at line 216 of file ErriezDS3231.cpp.

4.1.2.26 writeBuffer()

```
bool ErriezDS3231::writeBuffer (
            uint8_t reg,
            void * buffer,
            uint8_t len )
```

Write buffer to RTC.

Please refer to the RTC datasheet.

Parameters

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

Return values

true	Success
false	I2C write failed.

Definition at line 801 of file ErriezDS3231.cpp.

4.1.2.27 writeRegister()

```
bool ErriezDS3231::writeRegister (
            uint8_t reg,
            uint8_t value )
```

Write to RTC register.

Please refer to the RTC datasheet.

Parameters

reg	RTC register number 0x00..0x12.
value	8-bit unsigned register value.

Definition at line 780 of file ErriezDS3231.cpp.

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

- src/ErriezDS3231.h
- src/ErriezDS3231.cpp

Chapter 5

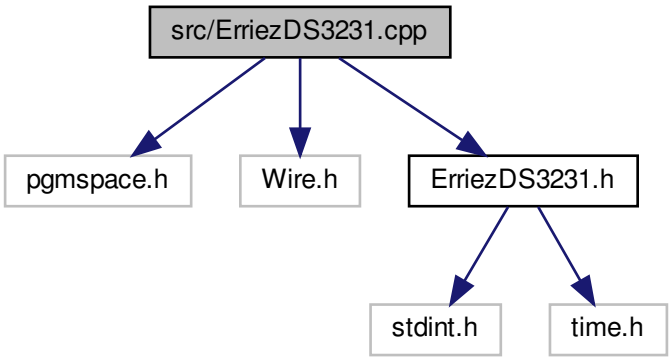
File Documentation

5.1 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:



5.1.1 Detailed Description

DS3231 high precision RTC library for Arduino.

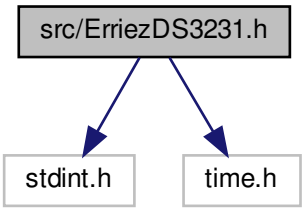
Source: https://github.com/Erriez/ErriezDS3231 Documentation: https://erriez.↩
github.io/ErriezDS3231

5.2 src/ErriezDS3231.h File Reference

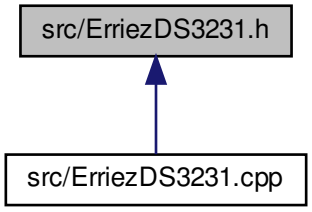
DS3231 high precision RTC library for Arduino.

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

Include dependency graph for ErriezDS3231.h:



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



Classes

- class ErriezDS3231

  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.

Enumerations

- enum AlarmId { Alarm1 = 1, Alarm2 = 2 }

  Alarm ID.
- enum Alarm1Type {
  Alarm1EverySecond = 0x0F, Alarm1MatchSeconds = 0x0E, Alarm1MatchMinutes = 0x0C, Alarm1Match↩
  Hours = 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.

5.2.1 Detailed Description

DS3231 high precision RTC library for Arduino.

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

5.2.2 Macro Definition Documentation

5.2.2.1 DS3231_HOUR_12H_24H

```
#define DS3231_HOUR_12H_24H 6
```

DS3231 register bit defines.

12 or 24 hour mode

Definition at line 66 of file ErriezDS3231.h.

5.2.2.2 DS3231_NUM_REGS

```
#define DS3231_NUM_REGS 19
```

DS3231 number of registers.

19 RTC register: 0x00..0x12

Definition at line 63 of file ErriezDS3231.h.

5.2.2.3 DS3231_REG_SECONDS

```
#define DS3231_REG_SECONDS 0x00
```

DS3231 registers.

Seconds register

Definition at line 40 of file ErriezDS3231.h.

5.2.3 Enumeration Type Documentation

5.2.3.1 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 112 of file ErriezDS3231.h.

5.2.3.2 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 125 of file ErriezDS3231.h.

5.2.3.3 AlarmId

`enum AlarmId`

Alarm ID.

Enumerator

Alarm1	Alarm ID 1.
Alarm2	Alarm ID 2.

Definition at line 104 of file ErriezDS3231.h.

5.2.3.4 SquareWave

`enum SquareWave`

Squarewave enum.

Enumerator

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

Definition at line 137 of file ErriezDS3231.h.

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