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

- libc `<time.h>` compatible
- Read/write date/time `struct tm`
- Set/get Unix epoch UTC `time_t`
- Set/get time (hour, min, sec)
- Set/get date and time (hour, min, sec, mday, mon, year, wday)
- 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**: ESP12F / 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
- `DumpRegisters` Dump registers polled
- `SetBuildDateTime` Set build date/time
- `SetGetDateTime` Simple RTC read date/time example
- `SetGetTime` Set/Get time
- `SQWInterrupt` Blink LED on SQW interrupt pin
- `Temperature` Temperature
- `Terminal` Advanced terminal interface with `set date/time Python` script
- `Test` Regression test
- `WriteRead` Write/read `struct tm`

Documentation

- Doxygen online HTML
- Doxygen PDF
- DS3231 datasheet

Usage

Initialization

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

// Create RTC object
ErriezDS3231 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: RTC oscillator stopped. Date/time cannot be trusted.
    // Set new date/time before reading date/time.

    // Enable oscillator
    rtc.clockEnable(true);
}
```

Set time

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

Set date and time

```
{c++}
// Write RTC date/time: 13:45:09  31 December 2019  0=Sunday, 2=Tuesday
if (!rtc.setDateTime(13, 45, 9,  31, 12, 2019,  2) {
    // Error: RTC write failed
}
```

Get date and time

```
{c++}
uint8_t hour;
uint8_t min;
uint8_t sec;
uint8_t mday;
uint8_t mon;
uint16_t year;
uint8_t wday;

// Read RTC date/time
if (!rtc.getDateTime(&hour, &min, &sec, &mday, &mon, &year, &wday) {
    // Error: RTC read failed
}

// hour: 0..23
// min: 0..59
// sec: 0..59
// mday: 1..31
// mon: 1..12
// year: 2000..2099
// wday: 0..6 (0=Sunday .. 6=Saturday)
```

Write date/time struct tm

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

dt.tm_hour = 12;
dt.tm_min = 34;
dt.tm_sec = 56;
dt.tm_mday = 29;
dt.tm_mon = 1; // 0=January
dt.tm_year = 2020-1900;
dt.tm_wday = 6; // 0=Sunday

if (!rtc.write(&dt)) {
    // Error: RTC Read failed
}
```

Read date/time struct tm

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

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

Read Unix Epoch UTC

```
{c++}
time_t t;

// Read Unix epoch UTC from RTC
if (!rtc.getEpoch(&t)) {
    // Error: RTC read failed
}
```

Write Unix Epoch UTC

```
{c++}
// Write Unix epoch UTC to RTC
if (!rtc.setEpoch(1599416430UL)) {
    // Error: Set epoch failed
}
```

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 (!rtc.startTemperatureConversion()) {
    // Error: Start temperature conversion failed
}

// Read temperature
if (!rtc.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
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 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
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
    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
```

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)`
	`void setDateTime(uint8_t hour, uint8_t min, uint8↩ _t sec, uint8_t mday, uint8_t mon, uint16_t year, uint8_t wday)`
	`void getDateTime(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.

More Arduino Libraries from Erriez

- `Erriez Libraries`

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 class.

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

Public Member Functions

- bool begin ()

  Initialize and detect DS3231 RTC.
- bool isRunning ()

  Read RTC OSF (Oscillator Stop Flag) from status register.
- bool clockEnable (bool enable=true)

  Enable or disable oscillator when running on V-BAT.
- 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 getDateTime (uint8_t ∗hour, uint8_t ∗min, uint8_t ∗sec, uint8_t ∗mday, uint8_t ∗mon, uint16_t ∗year, uint8_t ∗wday)

  Get 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 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 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 534 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 799 of file ErriezDS3231.cpp.

4.1.2.3 begin()

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

Initialize and detect DS3231 RTC.

Call this function from setup().

Return values

true	RTC detected.
false	RTC not detected.

Definition at line 52 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

alarm↩ Id	Alarm1 or Alarm2 enum.

Return values

true	Success
false	Incorrect alarm ID.

Definition at line 596 of file ErriezDS3231.cpp.

4.1.2.5 clockEnable()

```
bool ErriezDS3231::clockEnable (
            bool enable = true )
```

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 74 of file ErriezDS3231.cpp.

4.1.2.6 decToBcd()

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

Decimal to BCD conversion.

Parameters

dec	Decimal value.

Returns

BCD encoded value.

Definition at line 811 of file ErriezDS3231.cpp.

4.1.2.7 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 714 of file ErriezDS3231.cpp.

4.1.2.8 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

alarm↵ Id	Alarm1 or Alarm2 enum.

Return values

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

Definition at line 573 of file ErriezDS3231.cpp.

4.1.2.9 getDateTime()

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

Get 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=Saturday)

Return values

true	Success.
false	Get date/time failed.

Definition at line 394 of file ErriezDS3231.cpp.

4.1.2.10 getEpoch()

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

Read Unix UTC epoch time_t.

Returns

Unix epoch time_t seconds since 1970.

Definition at line 127 of file ErriezDS3231.cpp.

4.1.2.11 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 769 of file ErriezDS3231.cpp.

4.1.2.12 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 306 of file ErriezDS3231.cpp.

4.1.2.13 isRunning()

```
bool ErriezDS3231::isRunning ( )
```

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

Definition at line 110 of file ErriezDS3231.cpp.

4.1.2.14 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 653 of file ErriezDS3231.cpp.

4.1.2.15 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	Read failed.

Definition at line 187 of file ErriezDS3231.cpp.

4.1.2.16 readBuffer()

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

Read buffer from RTC.

Parameters

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

Return values

true	Success
false	I2C read failed.

Definition at line 897 of file ErriezDS3231.cpp.

4.1.2.17 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 825 of file ErriezDS3231.cpp.

4.1.2.18 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 684 of file ErriezDS3231.cpp.

4.1.2.19 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 444 of file ErriezDS3231.cpp.

4.1.2.20 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 495 of file ErriezDS3231.cpp.

4.1.2.21 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=Saturday)

Return values

true	Success.
false	Set date/time failed.

Definition at line 354 of file ErriezDS3231.cpp.

4.1.2.22 setEpoch()

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

Write Unix epoch UTC time to RTC.

Parameters

t	time_t time

Return values

true	Success.
false	Set epoch failed.

Definition at line 159 of file ErriezDS3231.cpp.

4.1.2.23 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 627 of file ErriezDS3231.cpp.

4.1.2.24 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 280 of file ErriezDS3231.cpp.

4.1.2.25 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 741 of file ErriezDS3231.cpp.

4.1.2.26 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

dt	Date/time struct tm. Providing invalid date/time data may result in unpredictable behavior.

Return values

true	Success.
false	Write failed.

Definition at line 243 of file ErriezDS3231.cpp.

4.1.2.27 writeBuffer()

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

Write buffer to RTC.

Please refer to the RTC datasheet.

Parameters

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

Return values

true	Success
false	I2C write failed.

Definition at line 869 of file ErriezDS3231.cpp.

4.1.2.28 writeRegister()

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

Write register.

Please refer to the RTC datasheet.

Parameters

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

Return values

true	Success
false	Write register failed

Definition at line 848 of file ErriezDS3231.cpp.

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

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

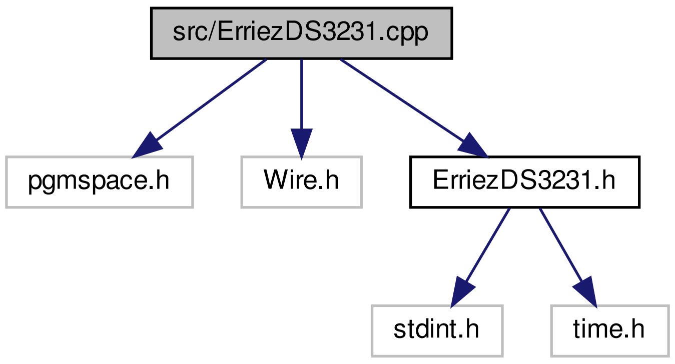
Chapter 5

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.

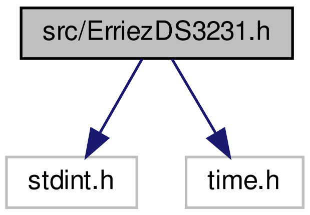
Source: https://github.com/Erriez/ErriezDS3231 Documentation: https://erriez.↩
github.io/ErriezDS3231

5.2 src/ErriezDS3231.h File Reference

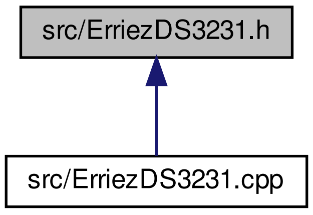
DS3231 high precision RTC library for Arduino.

```
#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 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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