
LwDTC

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Sep 30, 2022

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Welcome to the documentation for version latest-develop.

LwDTC is lightweight, platform independent library for date, time and cron utility management.

Main motivation comes from the necessity of simple cron for my own personal home automation project, with 1 second granularity.

[Download library](#) [Getting started](#) [Open Github](#) [Donate](#)

FEATURES

- Written in ANSI C99
- Platform independent, easy to use
- Support for date, time and cron utilities
- Ultra-lightweight cron library for embedded systems
- Cron supports numbers only, no string dates/months, quicker parsing
- Support for *time.h struct tm* data structure for time operations
- Date and time range support with CRON syntax
- User friendly MIT license

REQUIREMENTS

- C compiler
- Few *kB* of non-volatile memory

CONTRIBUTE

Fresh contributions are always welcome. Simple instructions to proceed:

1. Fork Github repository
2. Respect [C style & coding rules](#) used by the library
3. Create a pull request to `develop` branch with new features or bug fixes

Alternatively you may:

1. Report a bug
2. Ask for a feature request

LICENSE

MIT License

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5.1 Getting started

Getting started may be the most challenging part of every new library. This guide is describing how to start with the library quickly and effectively

5.1.1 Download library

Library is primarily hosted on [Github](#).

You can get it by:

- Downloading latest release from [releases area](#) on Github
- Cloning `main` branch for latest stable version
- Cloning `develop` branch for latest development

Download from releases

All releases are available on Github [releases area](#).

Clone from Github

First-time clone

This is used when you do not have yet local copy on your machine.

- Make sure `git` is installed.
- Open console and navigate to path in the system to clone repository to. Use command `cd your_path`
- Clone repository with one of available options below
 - Run `git clone --recurse-submodules https://github.com/MaJerle/lwdtc` command to clone entire repository, including submodules
 - Run `git clone --recurse-submodules --branch develop https://github.com/MaJerle/lwdtc` to clone *development* branch, including submodules
 - Run `git clone --recurse-submodules --branch main https://github.com/MaJerle/lwdtc` to clone *latest stable* branch, including submodules
- Navigate to `examples` directory and run favourite example

Update cloned to latest version

- Open console and navigate to path in the system where your repository is located. Use command `cd your_path`
- Run `git pull origin main` command to get latest changes on main branch
- Run `git pull origin develop` command to get latest changes on develop branch
- Run `git submodule update --init --remote` to update submodules to latest version

Note: This is preferred option to use when you want to evaluate library and run prepared examples. Repository consists of multiple submodules which can be automatically downloaded when cloning and pulling changes from root repository.

5.1.2 Add library to project

At this point it is assumed that you have successfully download library, either cloned it or from releases page. Next step is to add the library to the project, by means of source files to compiler inputs and header files in search path

- Copy `lwdtc` folder to your project, it contains library files
- Add `lwdtc/src/include` folder to *include path* of your toolchain. This is where *C/C++* compiler can find the files during compilation process. Usually using `-I` flag
- Add source files from `lwdtc/src/` folder to toolchain build. These files are built by *C/C++* compiler
- Copy `lwdtc/src/include/lwdtc/lwdtc_opts_template.h` to project folder and rename it to `lwdtc_opts.h`
- Build the project

5.1.3 Configuration file

Configuration file is used to overwrite default settings defined for the essential use case. Library comes with template config file, which can be modified according to needs. and it should be copied (or simply renamed in-place) and named `lwdtc_opts.h`

Note: Default configuration template file location: `lwdtc/src/include/lwdtc/lwdtc_opts_template.h`. File must be renamed to `lwdtc_opts.h` first and then copied to the project directory where compiler include paths have access to it by using `#include "lwdtc_opts.h"`.

List of configuration options are available in the *Configuration* section. If any option is about to be modified, it should be done in configuration file

Listing 1: Template configuration file

```
1 /**
2  * \file          lwdtc_opts_template.h
3  * \brief        LwDTC configuration file
4  */
5
6 /**
7  * Copyright (c) 2022 Tilen MAJERLE
```

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```

8  *
9  * Permission is hereby granted, free of charge, to any person
10 * obtaining a copy of this software and associated documentation
11 * files (the "Software"), to deal in the Software without restriction,
12 * including without limitation the rights to use, copy, modify, merge,
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20 * THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND,
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24 * HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY,
25 * WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING
26 * FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR
27 * OTHER DEALINGS IN THE SOFTWARE.
28 *
29 * This file is part of LwDTC - Lightweight Date, Time & Cron library.
30 *
31 * Author:          Tilen MAJERLE <tilen@majerle.eu>
32 * Version:         $_version_$
33 */
34 #ifndef LWDTCHDR_OPTS_H
35 #define LWDTCHDR_OPTS_H
36
37 /* Rename this file to "lwdtc_opts.h" for your application */
38
39 /*
40 * Open "include/lwdtc/lwdtc_opt.h" and
41 * copy & replace here settings you want to change values
42 */
43
44 #endif /* LWDTCHDR_OPTS_H */

```

Note: If you prefer to avoid using configuration file, application must define a global symbol `LWDTCHDR_IGNORE_USER_OPTS`, visible across entire application. This can be achieved with `-D` compiler option.

5.2 User manual

5.2.1 CRON

LwDTC provides ultra-lightweight support for simple CRON implementation. This page tends to provide quick information to be able to quickly move forward.

In the current revision library doesn't support true scheduler, instead it supports CRON string parser, and dedicated function to check if CRON is valid against compared time.

Tip: User can implement its own CRON loop, that reads current time and checks if parsed CRON is valid for specific time. Use `lwdtc_cron_is_valid_for_time()` to compare

Supported characters

- Numbers between minimum and maximum value for each of date and time field
- Support for seconds, minutes, hours, day-in-month, month, day-in-week and year,
- - is used to define value range, with min and max boundaries, min-max or max-min
- , is used to specific multiple fixed values
- / is used to define step between min and max values
- * is used to represent *any* value

Note: Comparing to standard linux CRON, where fixed date in month and week day are bitwise-ORed, meaning cron will fire on day in month match or on week day match, LwDTC does it more simple. Date&Time is valid only if both parameters are match at the same time. In practice, setting cron to fire on month-day = 15 and week-day = 6, will trigger it only on 15th in a month which is also Saturday at the same time.

CRON string format

To define valid CRON string, a string with 7 parameters, separated by space, must be provided:

seconds minutes hours day-in-month month day-in-week year

Each of them has to be present to consider CRON as valid input.

CRON examples

This section provides list of some CRON examples in its default configuration.

CRON string	Description
* * * * *	CRON is valid all the time, will fire every second
0 * * * * *	CRON is valid at the beginning of each minute
* * * * * 2 *	CRON is valid every Tuesday all day long
0 0 13-15 * * 2-4 *	CRON is valid every beginning of the minute between hours 13-15 afternoon, between Tuesday and Thursday
*/5 * * * * *	CRON is valid every 5 seconds starting at 0
*/5 */5 * * * * *	CRON is valid every 5 seconds each 5 minutes, from 00:00 to 55:55
0 0 0 * * 5 *	Every Friday at midnight
0 0 */2 * * * *	Every 2 hours at beginning of the hour
* * */2 * * * *	Every second of every minute every 2 hours (0, 2, 4, ..., 22)
0 0 0 * * 1-5 *	At midnight, 00:00 every week between Monday and Friday
15 23 */6 * * * *	Every 6 hours at (min:sec) 23:15 (00:23:15, 06:23:15, 12:23:15, ...)
0 0 0 1 * * *	At 00:00:00 beginning of the month
0 0 0 1 */3 * *	Every beginning of the quarter at 00:00:00
10 15 20 * 8 6 *	At 20:15:20 every Saturday in August
10 15 20 8 * 6 *	At 20:15:20 every Saturday that is also 8th day in month (both must match, day Saturday and date 8th)
30-45 * * * * * *	Every second between 30 and 45
30-45/3 * * * * * * *	Every 3rd second in every minute, when seconds are between 30 and 45
0 23/1 * * * * * *	Every beginning of a minute when minute is between 23 and 59
50-10 * * * * * *	Every second when seconds are from 50-59 and 00-10 (overflow mode)

Listing 2: Basic CRON example with parser

```

1 #include "windows.h"
2 #include <time.h>
3 #include <stdio.h>
4 #include "lwdtc/lwdtc.h"
5
6 int
7 cron_basic(void) {
8     /* Define context for CRON, used to parse data to */
9     lwdtc_cron_ctx_t cron_ctx = {0};
10    struct tm* timeinfo;
11    time_t rawtime, rawtime_old = 0;
12
13    /* Execute cron to be valid every 2 seconds */
14    if (lwdtc_cron_parse(&cron_ctx, "*/2 * * * * *") != lwdtcOK) {
15        printf("Error parsing CRON...\r\n");
16        while (1) {}
17    }
18    while (1) {
19        /* Get current time and react on changes only */

```

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```

20     time(&rawtime);
21
22     /* Check if new time has changed versus last read */
23     if (rawtime != rawtime_old) {
24         rawtime_old = rawtime;
25         timeinfo = localtime(&rawtime);
26
27         /* Print time to user */
28         printf("Time: %02d.%02d.%04d %02d:%02d:%02d\r\n",
29             (int)timeinfo->tm_mday, (int)timeinfo->tm_mon, (int)timeinfo->tm_year +
↪1900,
30             (int)timeinfo->tm_hour, (int)timeinfo->tm_min, (int)timeinfo->tm_sec
31         );
32
33         /* Check if CRON should execute */
34         if (lwdtc_cron_is_valid_for_time(timeinfo, &cron_ctx) == lwdtcOK) {
35             printf("Executing CRON task\r\n");
36         }
37     }
38
39     /* This is sleep from windows.h lib */
40     Sleep(100);
41 }
42 return 0;
43 }

```

5.2.2 CRON basic schedule

The idea behind cron is to schedule tasks at specific interval or period of time.

Library does not provide generic scheduler that would do that automatically for you, instead user should manually implement custom scheduler to periodically check and schedule should cron execute or not.

Tip: A check should be performed at least at minimum cron granularity, that being 1 second in the current revision.

Basic example is very simple and does the following:

- Parses cron defined by user with `:cpp:`lwdtc_cron_parse`` function
- Reads system time periodically (example was tested under *Windows* environment)
- It checks if cron is valid for execution each time new time changes versus previous check
- It executes task

Listing 3: Basic CRON example with parser

```

1 #include "windows.h"
2 #include <time.h>
3 #include <stdio.h>
4 #include "lwdtc/lwdtc.h"
5

```

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```

6  int
7  cron_basic(void) {
8      /* Define context for CRON, used to parse data to */
9      lwdtc_cron_ctx_t cron_ctx = {0};
10     struct tm* timeinfo;
11     time_t rawtime, rawtime_old = 0;
12
13     /* Execute cron to be valid every 2 seconds */
14     if (lwdtc_cron_parse(&cron_ctx, "**/2 * * * * *") != lwdtcOK) {
15         printf("Error parsing CRON...\r\n");
16         while (1) {}
17     }
18     while (1) {
19         /* Get current time and react on changes only */
20         time(&rawtime);
21
22         /* Check if new time has changed versus last read */
23         if (rawtime != rawtime_old) {
24             rawtime_old = rawtime;
25             timeinfo = localtime(&rawtime);
26
27             /* Print time to user */
28             printf("Time: %02d.%02d.%04d %02d:%02d:%02d\r\n",
29                 (int)timeinfo->tm_mday, (int)timeinfo->tm_mon, (int)timeinfo->tm_year +
↪1900,
30                 (int)timeinfo->tm_hour, (int)timeinfo->tm_min, (int)timeinfo->tm_sec
31                 );
32
33             /* Check if CRON should execute */
34             if (lwdtc_cron_is_valid_for_time(timeinfo, &cron_ctx) == lwdtcOK) {
35                 printf("Executing CRON task\r\n");
36             }
37         }
38
39         /* This is sleep from windows.h lib */
40         Sleep(100);
41     }
42     return 0;
43 }

```

5.2.3 CRON multi schedule

Consider a task that has to execute at different times or periods of time, for example:

- Each Friday at exactly midnight `0 0 0 * * 5 *` and
- Each second every Tuesday `* * * * * 2 *`

With CRON syntax, it is not possible to describe this with one string, as it does not allow multi range option. Solution is to rather use *multiple* definitions and then let scheduler to check all of them until at least one is a match.

Tip: LwDTC comes with `*_multi` functions allowing you to check several CRON contexts with single function

call.

An example shows simple demo how to implement a task scheduler which executes at different CRON context-es. It implements calls to `_multi` functions for simplification

Listing 4: CRON execution at multiple ranges

```

1  #include "windows.h"
2  #include <time.h>
3  #include <stdio.h>
4  #include "lwdtc/lwdtc.h"
5
6  /* Define all cron strings to execute one task */
7  static const char* cron_strings[] = {
8      "* * * * * 2 *",           /* Task should run every second every Tuesday */
9      "0 0 0 * * 5 *",         /* Task should run every Friday at midnight */
10 };
11
12 /* Set array of context objects */
13 static lwdtc_cron_ctx_t cron_ctxs[LWDTM_ARRAYSIZE(cron_strings)];
14
15 int
16 cron_multi(void) {
17     /* Define context for CRON, used to parse data to */
18     struct tm* timeinfo;
19     time_t rawtime, rawtime_old = 0;
20     size_t fail_index;
21
22     /* Parse all cron strings */
23     if (lwdtc_cron_parse_multi(cron_ctxs, cron_strings, LWDTM_ARRAYSIZE(cron_ctxs), &
↪fail_index) != lwdtcOK) {
24         printf("Failed to parse cron at index %d\r\n", (int)fail_index);
25         return 0;
26     }
27     printf("CRONs parsed and ready to go\r\n");
28
29     while (1) {
30         /* Get current time and react on changes only */
31         time(&rawtime);
32
33         /* Check if new time has changed versus last read */
34         if (rawtime != rawtime_old) {
35             rawtime_old = rawtime;
36             timeinfo = localtime(&rawtime);
37
38             /*
39              * Check if CRON should execute for all possible cron objects
40              *
41              * At least one task should be a pass to execute the task
42              */
43             if (lwdtc_cron_is_valid_for_time_multi_or(timeinfo, cron_ctxs, LWDTM_
↪ARRAYSIZE(cron_ctxs)) == lwdtcOK) {
44                 printf("Executing CRON task\r\n");

```

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```

45     }
46 }
47
48     /* This is sleep from windows.h lib */
49     Sleep(100);
50 }
51 return 0;
52 }

```

5.2.4 CRON date&time range

Motivation for LwDTC library comes with my home automation project, where I need a simple way to define range of date or time, from and to, in very flexible and field-agnostic way. It should be possible to just define from and to seconds within a minute, or from 2 different minutes and different seconds.

CRON concept doesn't provide such functionality. To overcome such problem, a simple solution with multiple cron objects can be implemented. Consider a task, that needs to execute each beginning of a minute, between Monday starting at 07:00:00 and Friday ending at 19:30:00.

For CRON-like compatible syntax, defined range needs a split to:

- *Monday*: CRON is active every beginning of a minute from 07 to 23 hours. This can be described as: `0 * 7/1 * * 1 *`
- *Tue,Wed,Thu*: CRON is active at beginning of each minute for all 3 days: `0 * * * * 2-4 *`
- *Friday*:
 - CRON is active between 0 and 19 hours, at beginning of each minute: `0 * 7-19 * * 5 *`
 - CRON is also active at beginning of each minute, when minutes are between 0 and 30 and when hour is 19: `0 0-30 19 * * 5 *`

This gives us in total 4 different cron objects, for which:

- We need to parse all of them
- To check if particular time is within range, an *OR* operation between all ranges is performed

Listing 5: CRON date&time range descriptor

```

1 #include "windows.h"
2 #include <time.h>
3 #include <stdio.h>
4 #include "lwdtc/lwdtc.h"
5
6 /*
7  * This is example for docs user manual
8  *
9  * Defines time range:
10 * - Starts at Monday at 07:00 morning
11 * - Ends on Friday at 19:30 evening
12 */
13 static const char* cron_strings[] = {
14     "0 * 7/1 * * 1 *",
15     "0 * * * * 2-4 *",

```

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```

16     "0 * 7-19 * * 5 *",
17     "0 0-30 19 * * 5 *"
18 };
19
20 /* Define context array for all CRON strings */
21 static lwdtc_cron_ctx_t cron_ctx[LWDTDC_ARRAYSIZE(cron_strings)] = {0};
22
23 int
24 cron_dt_range(void) {
25     /* Define context for CRON, used to parse data to */
26     struct tm* timeinfo;
27     time_t rawtime, rawtime_old = 0;
28
29     /* Parse all CRON strings */
30     for (size_t i = 0; i < LWDTDC_ARRAYSIZE(cron_strings); ++i) {
31         if (lwdtc_cron_parse(&cron_ctx[i], cron_strings[i]) != lwdtcOK) {
32             printf("Could not parse CRON: %s\r\n", cron_strings[i]);
33             while (1) {}
34         }
35     }
36
37     while (1) {
38         /* Get current time and react on changes only */
39         time(&rawtime);
40
41         /* Check if new time has changed versus last read */
42         if (rawtime != rawtime_old) {
43             rawtime_old = rawtime;
44             timeinfo = localtime(&rawtime);
45
46             /* Print time to user */
47             printf("Time: %02d.%02d.%04d %02d:%02d:%02d\r\n",
48                 (int)timeinfo->tm_mday, (int)timeinfo->tm_mon, (int)timeinfo->tm_year + 1900,
49                 (int)timeinfo->tm_hour, (int)timeinfo->tm_min, (int)timeinfo->tm_sec
50             );
51
52             /* Check if current time fits inside CRON-defined time range */
53             if (lwdtc_cron_is_valid_for_time_multi_or(timeinfo, cron_ctx, LWDTDC_
54                 ARRAYSIZE(cron_ctx)) == lwdtcOK) {
55                 printf("Time is within CRON range\r\n");
56             } else {
57                 printf("Time is NOT within CRON range\r\n");
58             }
59
60             /* This is sleep from windows.h lib */
61             Sleep(100);
62         }
63         return 0;
64     }

```


5.3 API reference

List of all the modules:

5.3.1 LwDTC

group **LwDTC**

Lightweight Date, Time & Cron utility.

Defines

LwDTC_SEC_MIN

Minimum value for seconds field

LwDTC_SEC_MAX

Maximum value for seconds field

LwDTC_MIN_MIN

Minimum value for minutes field

LwDTC_MIN_MAX

Maximum value for minutes field

LwDTC_HOUR_MIN

Minimum value for hours field

LwDTC_HOUR_MAX

Maximum value for hours field

LwDTC_MDAY_MIN

Minimum value for day in month field

LwDTC_MDAY_MAX

Maximum value for day in month field

LwDTC_MON_MIN

Minimum value for month field

LwDTC_MON_MAX

Maximum value for month field

LwDTC_WDAY_MIN

Minimum value for week day field (min = Sunday, max = Saturday)

LWDTC_WDAY_MAX

Maximum value for week day field (min = Sunday, max = Saturday)

LWDTC_YEAR_MIN

Minimum value for year field

LWDTC_YEAR_MAX

Maximum value for year field

LWDTC_ARRAYSIZE(x)

Calculate size of statically allocated array.

Parameters

- **x** – [in] Array

Returns Number of elements

Enums

enum **lwdtcr_t**

Result enumeration.

Values:

enumerator **lwdtcOK** = 0x00

Everything is OK

enumerator **lwdtcERR**

Generic error

enumerator **lwdtcERRPAR**

Invalid parameter passed to a function

enumerator **lwdtcERRTOKEN**

Token value is not valid

Functions

lwdtcr_t **lwdtc_cron_parse_with_len**(*lwdtc_cron_ctx_t* *ctx, const char *cron_str, size_t cron_str_len)

Parse string with linux crontab-like syntax, optionally enriched according to configured settings.

Parameters

- **ctx** – [in] Cron context variable used for storing parsed result
- **cron_str** – [in] Input cron string to parse data, using valid cron format recognized by the lib
- **cron_str_len** – [in] Length of input cron string, not counting potential NULL termination character

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_cron_parse**(*lwdtc_cron_ctx_t* *ctx, const char *cron_str)

Parse string with linux crontab-like syntax, optionally enriched according to configured settings.

Parameters

- **ctx** – [in] Cron context variable used for storing parsed result
- **cron_str** – [in] NULL terminated cron string, using valid cron format recognized by the lib

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_cron_parse_multi**(*lwdtc_cron_ctx_t* *cron_ctx, const char **cron_strs, size_t ctx_len, size_t *fail_index)

Parse multiple CRON strings at the same time. It returns immediately on first failed CRON.

Parameters

- **cron_ctx** – [in] Cron context variable used for storing parsed result
- **cron_strs** – [in] Pointer to array of string pointers with cron strings
- **ctx_len** – [in] Number of elements to process
- **fail_index** – [out] Optional pointer to output variable to store array index of failed CRON. Used only if function doesn't return *lwdtcOK*, otherwise pointer doesn't get modified

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_cron_is_valid_for_time**(const struct tm *tm_time, const *lwdtc_cron_ctx_t* *cron_ctx)

Check if cron is active at specific moment of time, provided as parameter.

Parameters

- **tm_time** – [in] Current time to check if cron works for it. Function assumes values in the structure are within valid boundaries and does not perform additional check
- **cron_ctx** – [in] Cron context object with valid structure

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_cron_is_valid_for_time_multi_or**(const struct tm *tm_time, const *lwdtc_cron_ctx_t* *cron_ctx, size_t ctx_len)

Check if current time fits to at least one of provided context arrays (OR operation)

Parameters

- **tm_time** – [in] Current time to check if cron works for it. Function assumes values in the structure are within valid boundaries and does not perform additional check
- **cron_ctx** – [in] Pointer to array of cron ctx objects
- **ctx_len** – [in] Number of context array length

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_cron_is_valid_for_time_multi_and**(const struct tm *tm_time, const *lwdtc_cron_ctx_t* *cron_ctx, size_t ctx_len)

Check if current time fits to all provided cron context arrays (AND operation)

Parameters

- **tm_time** – [in] Current time to check if cron works for it. Function assumes values in the structure are within valid boundaries and does not perform additional check
- **cron_ctx** – [in] Pointer to array of cron ctx objects
- **ctx_len** – [in] Number of context array length

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_tm_to_dt**(const struct tm *tm_time, *lwdtc_dt_t* *dt)

Convert struct tm to *lwdtc_dt_t* datetime structure.

Parameters

- **tm_time** – [in] Datetime structure from `time.h` header to be converted
- **dt** – [in] Datetime structure to write converted data to

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

lwdtcr_t **lwdtc_dt_to_tm**(const *lwdtc_dt_t* *dt, struct tm *tm_time)

Convert *lwdtc_dt_t* datetime structure to struct tm data type from `time.h` library.

Parameters

- **dt** – [in] Datetime structure to write converted data
- **tm_time** – [in] Datetime structure from `time.h` header to be converted

Returns *lwdtcOK* on success, member of *lwdtcr_t* otherwise

struct **lwdtc_cron_ctx_t**

#include <lwdtc.h> Cron context variable with parsed information.

It is a bit-field of ones and zeros, indicating a match (or not) for date-time comparison to determine if needs to run (or not) a task

Public Members

uint32_t **flags**

List of all sort of flags for internal use

uint8_t **sec**[8]

Seconds field. Must support bits from 0 to 59

uint8_t **min**[8]

Minutes field. Must support bits from 0 to 59

uint8_t **hour**[3]

Hours field. Must support bits from 0 to 23

uint8_t **mday**[4]

Day number in a month. Must support bits from 0 to 30

uint8_t **mon**[2]

Month field. Must support bits from 0 to 11

uint8_t **wday**[1]

Week day. Must support bits from 0 (Sunday) to 6 (Saturday)

uint8_t **year**[13]

Year from 0 - 100, indicating 2000 - 2100. Must support bits 0 to 100

struct **lwdtc_dt_t**

#include <lwdtc.h> Date and time structure of LwDTC library.

Not used for the moment, but defined as placeholder for the future.

Public Members

uint8_t **sec**

Seconds in a minute. Value between *LWDTC_SEC_MIN* and *LWDTC_SEC_MAX*

uint8_t **min**

Minutes in a hour. Value between *LWDTC_MIN_MIN* and *LWDTC_MIN_MAX*

uint8_t **hour**

Hours in a day. Value between *LWDTC_HOUR_MIN* and *LWDTC_HOUR_MAX*

uint8_t **mday**

Day in a month. Value between *LWDTC_MDAY_MIN* and *LWDTC_MDAY_MAX*

uint8_t **mon**

Month in a year. Value between *LWDTC_MON_MIN* and *LWDTC_MON_MAX*

uint8_t **wday**

Week day, between Sunday and Saturday. Value between *LWDTC_WDAY_MIN* and *LWDTC_WDAY_MAX*

uint8_t **year**

Year, starting with 2000. Value between *LWDTC_YEAR_MIN* and *LWDTC_YEAR_MAX*

Note: This is different versus `struct tm` from `time.h` library, where years start from 1900, hence year 2022 is written as 122 in `struct tm`, while same year is set as 22 this field

5.3.2 Configuration

This is the default configuration of the middleware. When any of the settings shall be modified, it shall be done in dedicated application config `lwdtc_opts.h` file.

Note: Check *Getting started* to create configuration file.

group **LWDTC_OPT**

Default configuration setup.

5.4 Changelog

```
# Changelog
## Develop
- Rework parameters to avoid ARM GCC warnings for uninitialized var
- Add support to define max-min option - with overflow
- Add ``.clang-format`` draft
```

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