

time_conversion.c File Reference

Detailed Description

GNSS core 'c' function library: converting time information.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-07-30

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42
- <http://aa.usno.navy.mil/data/docs/JulianDate.html> - Julian Date Converter
- <http://aa.usno.navy.mil/faq/docs/UT.html>
- <http://www.macho.mcmaster.ca/JAVA/JD.html>
- Raquet, J. F. (2002), GPS Receiver Design Lecture Notes. Geomatics Engineering, University of Calgary Graduate Course.

"LICENSE INFORMATION"

Copyright (c) 2007, refer to 'author' doxygen tags
All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- The name(s) of the contributor(s) may not be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE CONTRIBUTORS ``AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Definition in file [time_conversion.c](#).

```
#include <sys/timeb.h>
#include <time.h>
#include <math.h>
```

```
#include "time_conversion.h"
#include "constants.h"
```

[Go to the source code of this file.](#)

Functions

-
- BOOL **TIMECONV_GetSystemTime** (unsigned short *utc_year, unsigned char *utc_month, unsigned char *utc_day, unsigned char *utc_hour, unsigned char *utc_minute, float *utc_seconds, unsigned char *utc_offset, double *julian_date, unsigned short *gps_week, double *gps_tow)
Obtains the UTC time, GPS time, and Julian date from PC system time.
-
- BOOL **TIMECONV_GetJulianDateFromGPSTime** (const unsigned short gps_week, const double gps_tow, const unsigned char utc_offset, double *julian_date)
Computes the Julian date from GPS time.
-
- BOOL **TIMECONV_GetJulianDateFromUTCTime** (const unsigned short utc_year, const unsigned char utc_month, const unsigned char utc_day, const unsigned char utc_hour, const unsigned char utc_minute, const float utc_seconds, double *julian_date)
Computes the Julian date from UTC time.
-
- BOOL **TIMECONV_GetGPSTimeFromJulianDate** (const double julian_date, const unsigned char utc_offset, unsigned short *gps_week, double *gps_tow)
Computes GPS time from the Julian date.
-
- BOOL **TIMECONV_GetUTCTimeFromJulianDate** (const double julian_date, unsigned short *utc_year, unsigned char *utc_month, unsigned char *utc_day, unsigned char *utc_hour, unsigned char *utc_minute, float *utc_seconds)
Computes UTC time from the Julian date.
-
- BOOL **TIMECONV_GetGPSTimeFromUTCTime** (unsigned short utc_year, unsigned char utc_month, unsigned char utc_day, unsigned char utc_hour, unsigned char utc_minute, float utc_seconds, unsigned short *gps_week, double *gps_tow)
Computes GPS time from UTC time.
-
- BOOL **TIMECONV_GetGPSTimeFromRinexTime** (unsigned short utc_year, unsigned char utc_month, unsigned char utc_day, unsigned char utc_hour, unsigned char utc_minute, float utc_seconds, unsigned short *gps_week, double *gps_tow)
Computes GPS time from RINEX time. RINEX time looks like UTC but it is GPS time in year, month, day, hours, minutes, seconds.
-
- BOOL **TIMECONV_GetUTCTimeFromGPSTime** (unsigned short gps_week, double gps_tow, unsigned short *utc_year, unsigned char *utc_month, unsigned char *utc_day, unsigned char *utc_hour, unsigned char *utc_minute, float *utc_seconds)
Computes UTC time from GPS time.
-
- BOOL **TIMECONV_DetermineUTCOffset** (double julian_date, unsigned char *utc_offset)
This function is a look up table to determine the UTC offset from the Julian Date.
-
- BOOL **TIMECONV_GetNumberOfDaysInMonth** (const unsigned short year, const unsigned char month, unsigned char *days_in_month)
Determines the number of days in a month, given the month and year.
-
- BOOL **TIMECONV_IsALeapYear** (const unsigned short year)
Determines if the given year is a leap year.
-
- BOOL **TIMECONV_GetDayOfYear** (const unsigned short utc_year, const unsigned char utc_month, const unsigned char utc_day, unsigned short *dayofyear)
Determines the day of year given the year, month, and day.
-
- BOOL **TIMECONV_GetGPSTimeFromYearAndDayOfYear** (const unsigned short year, const unsigned short dayofyear, unsigned short *gps_week, double *gps_tow)
Determines the GPS time of the start of a day from the day of year and the year.
-

Function Documentation

```

BOOL TIMECONV_DetermineUTCOffset ( double      julian_date,
                                   unsigned char * utc_offset
                                   )

```

This function is a look up table to determine the UTC offset from the Julian Date.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

- This function must be updated when the next UTC *utc_offset step occurs. Current max is (13).

REFERENCES

- Raquet, J. F. (2002), GPS Receiver Design Lecture Notes. Geomatics Engineering, University of Calgary Graduate Course.

"Offset Table"

UTCOffset, UTC Date, Julian Date [days]

```
0, Jan 06 1980 00:00:00.0, 2444244.5000
```

1, Jul 01 1981 00:00:00.0, 2444786.5000

2, Jul 01 1982 00:00:00.0, 2445151.5000

3, Jul 01 1983 00:00:00.0, 2445516.5000

4, Jul 01 1985 00:00:00.0, 2446247.5000

5, Jan 01 1988 00:00:00.0, 2447161.5000

6, Jan 01 1990 00:00:00.0, 2447892.5000

7, Jan 01 1991 00:00:00.0, 2448257.5000

8, Jul 01 1992 00:00:00.0, 2448804.5000

9, Jul 01 1993 00:00:00.0, 2449169.5000

10, Jul 01 1994 00:00:00.0, 2449534.5000

11, Jan 01 1996 00:00:00.0, 2450083.5000

12, Jul 01 1997 00:00:00.0, 2450630.5000

13, Jan 01 1999 00:00:00.0, 2451179.5000

14, Jan 01 2006 00:00:00.0, 2453736.5000

Parameters:

julian_date Number of days since noon Universal Time Jan 1, 4713 BCE (Julian calendar) [days]

utc_offset Integer seconds that GPS is ahead of UTC time, always positive [s], obtained from a look up table

Definition at line **500** of file **time_conversion.c**.

[illegible]

```
const unsigned char utc_day,  
unsigned short * dayofyear  
)
```

Determines the day of year given the year, month, and day.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

(1) Performed independant comparison with
<http://www.mbari.org/staff/coletti/doytable.html>

Definition at line **599** of file **time_conversion.c**.

```
BOOL TIMECONV_GetGPSTimeFromJulianDate ( const double julian_date,  
const unsigned char utc_offset,  
unsigned short * gps_week,  
double * gps_tow  
)
```

Computes GPS time from the Julian date.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

julian_date Number of days since noon Universal Time Jan 1, 4713 BCE (Julian calendar) [days]
utc_offset Integer seconds that GPS is ahead of UTC time, always positive [s]
gps_week GPS week (0-1024+) [week]
gps_tow GPS time of week [s]

```
BOOL TIMECONV_GetGPSTimeFromRinexTime ( unsigned short   utc_year,  
                                           unsigned char    utc_month,  
                                           unsigned char    utc_day,  
                                           unsigned char    utc_hour,  
                                           unsigned char    utc_minute,  
                                           float            utc_seconds,  
                                           unsigned short * gps_week,  
                                           double *         gps_tow  
                                           )
```

Computes GPS time from RINEX time. RINEX time looks like UTC but it is GPS time in year, month, day, hours, minutes, seconds.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-12-07

Since:

2007-12-07

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

- There is no UTC offset to apply
- The RINEX time system must be the GPS Time system to use this function.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42
- RINEX version 2.11, (<http://www.aiub-download.unibe.ch/rinex/rinex211.txt>)

Parameters:

<i>utc_year</i>	Universal Time Coordinated [year]
<i>utc_month</i>	Universal Time Coordinated [1-12 months]
<i>utc_day</i>	Universal Time Coordinated [1-31 days]
<i>utc_hour</i>	Universal Time Coordinated [hours]
<i>utc_minute</i>	Universal Time Coordinated [minutes]
<i>utc_seconds</i>	Universal Time Coordinated [s]
<i>gps_week</i>	GPS week (0-1024+) [week]
<i>gps_tow</i>	GPS time of week (0-604800.0) [s]

Definition at line 405 of file `time_conversion.c`.

BOOL TIMECONV_GetGPSTimeFromUTCTime (unsigned short	<i>utc_year,</i>
unsigned char		<i>utc_month,</i>

```

        unsigned char    utc_day,
        unsigned char    utc_hour,
        unsigned char    utc_minute,
        float            utc_seconds,
        unsigned short *  gps_week,
        double *         gps_tow
    )

```

Computes GPS time from UTC time.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

(1) The utc offset is determined automatically from a look up table

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

utc_year Universal Time Coordinated [year]
utc_month Universal Time Coordinated [1-12 months]
utc_day Universal Time Coordinated [1-31 days]
utc_hour Universal Time Coordinated [hours]
utc_minute Universal Time Coordinated [minutes]
utc_seconds Universal Time Coordinated [s]
gps_week GPS week (0-1024+) [week]
gps_tow GPS time of week (0-604800.0) [s]

Definition at line [357](#) of file [time_conversion.c](#).

```

BOOL TIMECONV_GetGPSTimeFromYearAndDayOfYear ( const unsigned short year,
                                                const unsigned short dayofyear,
                                                unsigned short *    gps_week,
                                                double *           gps_tow
                                                )

```

Determines the GPS time of the start of a day from the day of year and the year.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-12-07

Since:

2007-12-07

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Parameters:

gps_week GPS week (0-1024+) [week]

gps_tow GPS time of week (0-604800.0) [s]

Definition at line **633** of file [time_conversion.c](#).

```
BOOL TIMECONV_GetJulianDateFromGPSTime ( const unsigned short gps_week,
                                           const double         gps_tow,
                                           const unsigned char   utc_offset,
                                           double *              julian_date
                                           )
```

Computes the Julian date from GPS time.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

gps_week GPS week (0-1024+) [week]

gps_tow GPS time of week (0-604800.0) [s]

utc_offset Integer seconds that GPS is ahead of UTC time, always positive [s]

julian_date Number of days since noon Universal Time Jan 1, 4713 BCE (Julian calendar) [days]

Definition at line **190** of file [time_conversion.c](#).

```
BOOL TIMECONV_GetJulianDateFromUTCTime ( const unsigned short utc_year,
                                           const unsigned char   utc_month,
                                           const unsigned char   utc_day,
                                           const unsigned char   utc_hour,
                                           const unsigned char   utc_minute,
```

```

const float      utc_seconds,
double *        julian_date
)

```

Computes the Julian date from UTC time.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

- Verified calculation using <http://aa.usno.navy.mil/data/docs/JulianDate.html>, a Julian Date Converter and <http://www.macho.mcmaster.ca/JAVA/JD.html>, another online converter tool.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

<i>utc_year</i>	Universal Time Coordinated [year]
<i>utc_month</i>	Universal Time Coordinated [1-12 months]
<i>utc_day</i>	Universal Time Coordinated [1-31 days]
<i>utc_hour</i>	Universal Time Coordinated [hours]
<i>utc_minute</i>	Universal Time Coordinated [minutes]
<i>utc_seconds</i>	Universal Time Coordinated [s]
<i>julian_date</i>	Number of days since noon Universal Time Jan 1, 4713 BCE (Julian calendar) [days]

Definition at line **206** of file **[time_conversion.c](#)**.

```

BOOL TIMECONV_GetNumberOfDaysInMonth ( const unsigned short year,
const unsigned char month,
unsigned char *      days_in_month
)

```

Determines the number of days in a month, given the month and year.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

year Universal Time Coordinated [year]
month Universal Time Coordinated [1-12 months]
days_in_month Days in the specified month [1-28|29|30|31 days]

Definition at line **530** of file **[time_conversion.c](#)**.

```
BOOL TIMECONV_GetSystemTime ( unsigned short * utc_year,  
                                unsigned char * utc_month,  
                                unsigned char * utc_day,  
                                unsigned char * utc_hour,  
                                unsigned char * utc_minute,  
                                float * utc_seconds,  
                                unsigned char * utc_offset,  
                                double * julian_date,  
                                unsigned short * gps_week,  
                                double * gps_tow  
)
```

Obtains the UTC time, GPS time, and Julian date from PC system time.

Author:

Glenn D. MacGougan (GDM)

Date:

2006-11-10

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

(1) Millisecond time is obtained

Parameters:

utc_year Universal Time Coordinated [year]
utc_month Universal Time Coordinated [1-12 months]
utc_day Universal Time Coordinated [1-31 days]
utc_hour Universal Time Coordinated [hours]
utc_minute Universal Time Coordinated [minutes]
utc_seconds Universal Time Coordinated [s]
utc_offset Integer seconds that GPS is ahead of UTC time, always positive [s],
 obtained from a look up table
julian_date Number of days since noon Universal Time Jan 1, 4713 BCE (Julian

	calendar) [days]
<i>gps_week</i>	GPS week (0-1024+) [week]
<i>gps_tow</i>	GPS time of week (0-604800.0) [s]

Definition at line **113** of file **time_conversion.c**.

```

BOOL TIMECONV_GetUTCTimeFromGPSTime ( unsigned short gps_week,
                                         double          gps_tow,
                                         unsigned short * utc_year,
                                         unsigned char *  utc_month,
                                         unsigned char *  utc_day,
                                         unsigned char *  utc_hour,
                                         unsigned char *  utc_minute,
                                         float *          utc_seconds
                                         )

```

Computes UTC time from GPS time.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

Remarks:

- The utc offset is determined automatically from a look up table

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

<i>gps_week</i>	GPS week (0-1024+) [week]
<i>gps_tow</i>	GPS time of week (0-604800.0) [s]
<i>utc_year</i>	Universal Time Coordinated [year]
<i>utc_month</i>	Universal Time Coordinated [1-12 months]
<i>utc_day</i>	Universal Time Coordinated [1-31 days]
<i>utc_hour</i>	Universal Time Coordinated [hours]
<i>utc_minute</i>	Universal Time Coordinated [minutes]
<i>utc_seconds</i>	Universal Time Coordinated [s]

Definition at line **449** of file **time_conversion.c**.

```

BOOL TIMECONV_GetUTCTimeFromJulianDate ( const double julian_date,

```

```
unsigned short * utc_year,
unsigned char * utc_month,
unsigned char * utc_day,
unsigned char * utc_hour,
unsigned char * utc_minute,
float * utc_seconds
)
```

Computes UTC time from the Julian date.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if successful, FALSE(0) otherwise.

REFERENCES

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice, Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Parameters:

julian_date Number of days since noon Universal Time Jan 1, 4713 BCE (Julian calendar) [days]
utc_year Universal Time Coordinated [year]
utc_month Universal Time Coordinated [1-12 months]
utc_day Universal Time Coordinated [1-31 days]
utc_hour Universal Time Coordinated [hours]
utc_minute Universal Time Coordinated [minutes]
utc_seconds Universal Time Coordinated [s]

Definition at line [269](#) of file [time_conversion.c](#).

BOOL TIMECONV_IsALeapYear (const unsigned short *year*)

Determines if the given year is a leap year.

Author:

Glenn D. MacGougan (GDM)

Date:

2007-11-29

Since:

2005-08-22

Returns:

TRUE(1) if the given year is a leap year, FALSE(0) otherwise

- Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins (1994). GPS Theory and Practice,

Third, revised edition. Springer-Verlag, Wien New York. pp. 38-42

Definition at line [566](#) of file [time_conversion.c](#).