



OPEN

Compute Project

NMEA UTC Message for Time Card and GNSS Receivers

A

1.2

Base Specification v1.2

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Author: NetTimeLogic GmbH – Sven Meier

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1.2 Acknowledgements

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2. Change Log

Date	Version #	Author	Description
27NOV23	1.0	Sven Meier	Initial Version
19DEC23	1.1	Sven Meier	Adapted according to review comments
22MAY24	1.2	Thomas Schaub	Added clarification for TAI Time (TAI Time as used in PTP/IEEE1588)

3 NMEA UTC Message

3.1. Background

Every GNSS receiver basically supports NMEA messages to transfer information via a serial interface (UART). NMEA standard messages do not contain TAI time or any UTC offset or leap second information. Since many timing application nowadays use GNSS as their reference for time it is desirable to have a standard way of not only transferring the UTC time like in e.g. RMC or ZDA messages, but also a continuous time base (without leap seconds) like TAI. For wall clock applications or wherever UTC time is desirable UTC sideband information is required to convert from TAI to UTC and to correctly handle leap second events.

In the scope of OCP Time Card where different GNSS receivers are possible it is desirable to have a standard way for transferring this UTC sideband information from the GNSS receivers to the Time Card. Otherwise for each GNSS receiver the vendor specific protocol needs to be implemented. However, this is not something specific to the Time Card but relevant for the timing appliances in general.

Therefore, a new NMEA message was defined. The format of the message is described in chapter 3.2.

3.2. NMEA UTC Message Format

\$GxUTC,TTTTTTTTTTTTTTTT,(-)ooo,(-)ttttttt,SS*CC

Message Attribute	Description																		
x	P (GPS), L (GLONASS), A (GALILEO), B (BEIDOU), N (All)																		
TTTTTTTTTTTTTTTT	Current TAI Time in seconds (0 to (2 ⁴⁸ -1); TAI Time as used in PTP/IEEE1588)																		
(-)ooo	Current TAI-UTC offset in seconds (-128 to 128)																		
(-)ttttttt	Time since last (negative) or to next (positive) leap second event in seconds (-99999999 to 99999999)																		
SS	Status as ASCII represented hex (00-FF, MSB left) <table border="1"> <thead> <tr> <th>Bit</th><th>Description</th></tr> </thead> <tbody> <tr> <td>0</td><td>TAI-UTC offset valid</td></tr> <tr> <td>1</td><td>Leap info valid</td></tr> <tr> <td>2</td><td>Leap61 announcement</td></tr> <tr> <td>3</td><td>Leap59 announcement</td></tr> <tr> <td>4</td><td>Time since last or to next leap event valid</td></tr> <tr> <td>5</td><td>TAI time valid</td></tr> <tr> <td>6</td><td>Reserved</td></tr> <tr> <td>7</td><td>Reserved</td></tr> </tbody> </table>	Bit	Description	0	TAI-UTC offset valid	1	Leap info valid	2	Leap61 announcement	3	Leap59 announcement	4	Time since last or to next leap event valid	5	TAI time valid	6	Reserved	7	Reserved
Bit	Description																		
0	TAI-UTC offset valid																		
1	Leap info valid																		
2	Leap61 announcement																		
3	Leap59 announcement																		
4	Time since last or to next leap event valid																		
5	TAI time valid																		
6	Reserved																		
7	Reserved																		
CC	Checksum (00-FF)																		

E.g. \$GPUTC,123456789,37,123456,37*XX
 \$GLUTC,987654321,,,20*XX

Message attributes which are not available or invalid can be omitted.

Leading zeros for values which require less characters than the range are allowed but not required, e.g. offset 37 and 037 are both valid

The message is supposed to be sent once per second.

The message allows to:

- Directly get a continuous time in TAI.
- Calculate the previous or next leap second event by adding the time since the last or to next leap second event to current TAI time.
- Convert the current TAI time to UTC time taking the leap seconds into account.