



Technical Bulletin

Time Synchronization in 7K IO Module

Version 1.1

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Amendment Record Sheet

Rev.	Date	Reason for Modifications
1.1	06/07/2012	Minor modifications to the document.
1.0	28/06/2012	First version of this Technical Bulletin.

Introduction

From the 7K IO Module 3.7.x.x onwards the time synchronization in the 7K IO Module is modified. This has resulted in that some clock device drivers are replaced by two generic clock device drivers.

In this document will be explained how the time synchronization was working in the previous versions (before 3.7.x.x) and how it is working now in the current version (3.7.x.x onwards).

In the current 7K IO Module an 'Obsolete' folder is created in which the 'legacy' clock device driver becomes available. In this document will be explained how the 'Obsolete' folder works and how the 'legacy' clock device drivers can be used.

Previous Time Synchronization

The 1PPS is a very stable time source, but the time of the pulse has no meaning unless we know the sensors clock time at the time of the pulse. Therefore GPS sensors also output a time message related to the 1PPS that contains the exact time of the pulse. This time output can either be in GPS time or in UTC, depending on the manufacturer of the GPS. The 1PPS time string out of the GPS receiver is proprietary and is outputted before or after the time pulse depending on the brand of the GPS.

Depending on the device driver and the brand of the GPS the leading edge T0 (positive or negative) of the 1PPS pulse is used to determine the time of the pulse. Detection of the positive or negative leading edge is based on the selection of the device driver. A wrong device driver will lead to a detection of the trailing edge T1 (the wrong edge). With a short pulse (1-2ms) this is no problem, but for a longer pulse length it will result in that the clock is set on the wrong time.

The time of the pulse is compared with the time in the time message from the GPS. The time set for the time of the pulse is the computer time while for the time in message it is the GPS time. Both these times should be identical but most of the times it results in a time difference between the computer clock and the GPS time. The 7K IO Module will correct the computer clock for this time difference.

NOTE: With the 7K IO Module versions before 3.7.x.x the 7K IO Module can only correct the computer clock for systems running with Windows XP. For systems with Windows Vista and Windows 7 a service, called PDS2000SettimeService, is needed to correct the computer clock. This service is only available from 7K IO Module versions 3.7.x.x. onwards.

Current Time Synchronization

The current version of the 7K IO Module uses the same method as described above. Only now a new routine is built in to do a better check on the computed time difference.

The new routine contains an automatic leading edge detection of the pulse and a better check on the comparison of the right time message with the right pulse time to compute the time difference. For a long pulse length the routine tries to find the best relation between the leading edge detection and the time message from the GPS by looking at the time of arrival, time in message and pulse time.

For a NMEA ZDA message without milliseconds the extra check is not done. For a NMEA ZDA message with milliseconds it works fine when only a few messages per second are send from the GPS receiver. When however a lot of messages (for instance ZDA and GST at 1Hz and GGA at 5Hz) are send from the GPS receiver, it is possible depending on the brand of the GPS that the receiver is sending the time message (NMEA ZDA) later. When the difference between the arrival time of the NMEA ZDA message and the time in the message is too big (>50 milliseconds) the message is not accepted. With a high baud rate this difference can be reduced, but it is still present! The check of 50ms is already 10 times more than

it should be. 5ms is a much better time check but experience shows that not all the GPS receivers send the time message on time.

For GPS receivers with a pulse with long edges (for instance Aquarius) this new routine is needed to avoid a time error of approximately 0.5sec. Without the new routine the wrong edge can be detected as the leading edge.

The following external clock drivers are the only drivers that use the new routine for the extra check on the edge detection and time check:

- Generic ZDA + 1PPS
- Trimble PPS

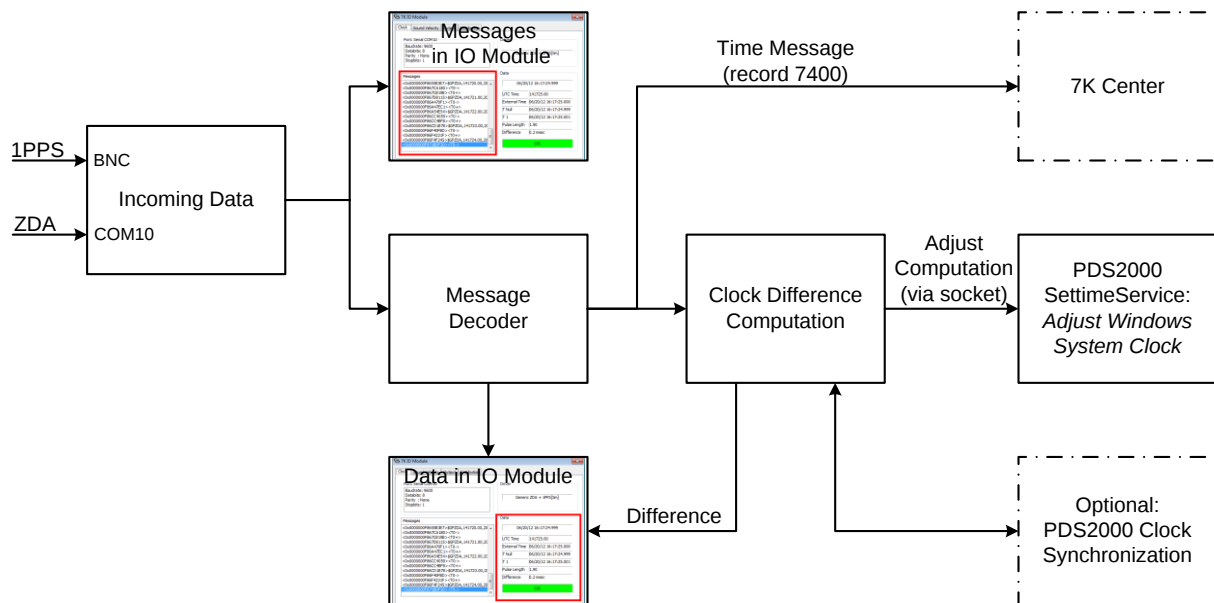


Figure 1 – Scheme of Time Synchronization in 7K IO Module

Next to the time synchronization, in the 7K IO Module version 3.7.0.14 (and earlier versions) the message display was not properly displaying the incoming data. Some of the messages were displayed two or more times while other were not displayed. This results in that it looks like that a T0+ or T0- was missing. The message display in the 7K IO Module is revised and the T0+, T0- and ZDA are now all displayed in the order as received from the GPS receiver.

Setup Time Synchronization

To setup a proper time synchronization the following items are important:

- Use always a NMEA ZDA with 1PPS, because of the possible latency in the NMEA ZDA time message (see above).
- Use the NMEA ZDA at 1Hz and set the baud rate as high as possible.
- Avoid to use, next to the NMEA ZDA message and 1PPS, other outputs from the GPS receiver on the same port.

Obsolete Folder

The Obsolete folder contains 'legacy' device drivers which are replaced by more general and improved drivers. For that reason the replaced external clock drivers are placed in the Obsolete folder.

In the current version of the 7K IO Module are the following external clock drivers moved to the Obsolete folder:

- Aquarius (new) ZDA & 1PPS
- Aquarius PPS & ZDA
- Aquarius PPS Negative & ZDA
- Ashtech G12 PPS & ZDA
- GBX ZDA
- Leica 1200 PPS+ZDA
- Sercel203pps&zda
- Trimble PPS+ZDA
- Trimble PPS+ZDA Pin 9

These drivers are replaced by:

- Generic ZDA + 1PPS

When one of these external clock drivers is already selected as external clock driver in the 7K IO Module then this drivers can still be used. The 7K IO Module will look in the General folder for the driver and if it cannot find the driver it will look in the Obsolete folder.

It is not possible anymore to select one of these replaced drivers in the 7K IO Module. This is to stimulate the customer to start using the more general and improved drivers.

When a customer still wants to use one of the replaced drivers, the driver can be copied from the Obsolete folder to the General folder. This has to be done each time a new version of the 7K IO Module is installed.