

PCIe TS

Real-Time Synchronization for Windows

Operating Instructions
Version: 3.0
December 4, 2020





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A1 Revision History

No.	Date	Subject
0.n		Preliminary documents, changes without notice.
2.4	January 9, 2007	Initial release.
2.7	June 2, 2009	Added PCIe TS. Supporting Windows 64-bit.
2.9	April 26, 2012	Supporting Windows Server 2003.
2.11	March 22, 2018	Plura brand.
2.12	September 25, 2019	Changed address of Plura Europe GmbH.
3.0	December 4, 2020	Re-formatted in new design.

A2 General Hints for Safe Operation

- General hints:** Please only use the equipment in dry rooms and according to the corresponding instructions in the operation manual of our equipment.
- Transportation damages:** In case of obvious damage caused during transportation, please inform the responsible forwarding agency. Please also get directly in touch with your dealer.
- Repairs:** As electronic state-of-the-art components have been used, no maintenance is required. The board does not contain any parts which might be repaired by yourself. **For this reason, any intervention should only be performed by an authorised service partner.**
- EMC** The EMC regulations are observed only under the following condition: use high quality shielded cables at data inputs and outputs.
- Please note:** In these operating instructions, we tried to make use of the standard English terms used by Windows. The screenshots will provide an additional help for users in other countries.



A3 Copyright

Copyright © by Plura Europe 1998 - 2019. All rights reserved.

Information in this publication supersedes that in all previously published material. Specifications are subject to change without notice.

The naming of other companies' products in this operating manual is for informational purposes only and no violation of trademark law.

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A4 CE - Declaration of Conformity

We,

Plura Europe GmbH
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declare under our sole responsibility that the

PCIe TS

to which this declaration relates are in conformity with the following standards:

1. EN 55022, Class B
2. IEC 801-2
3. IEC 801-3 / ENV 50140
4. EN 61000-4-4



B1 Introduction

PCIe TS is designed to synchronize the system clock of PCs running under Windows to a real-time coupled LTC signal. PCIe TS consist of the following two components:

- PCIe TS board with LTC reader
- “Plura TimeSys”, a Windows program

The PCIe TS board reads LTC and makes it available to Windows. The program consists of the following two components:

- The system service “Plura TimeSys” which ensures adjustment even if the user is not logged on.
- A monitor program which monitors the functioning of the “Plura TimeSys” service.

The real-time coupled LTC is generated e.g. by a Plura time code generator Rubidium GT. The generator receives the time information from a DCF or GPS receiver. The real time information is encoded in the LTC time. Date, information about the local time zone (CET, CEST, UTC) as well as status information on the reception status and an impending switch-over for daylight saving time are optionally encoded in the LTC user bits.

An adjusting algorithm of “Plura TimeSys” accelerates or moderates, respectively the system time to ensure maximum synchronization to the LTC real time reference. Seconds differences (caused e.g. by leap seconds, please see below) may be adjusted by a hard set of the system time, as required.

Moreover, it is possible to determine that larger differences - which will not occur during normal operation - for several minutes or even hours shall be ignored by the “Plura TimeSys” service. This does not apply to the switch-over for daylight saving time.

The “Plura TimeSys” service operates with UTC (Universal Time Coordinated), as used inside Windows, not with local time. UTC is a continuously counting time without time zones. Time jumps will only be produced in case of leap seconds, to adapt the time count to the earth rotation. For the daylight-saving time change-over only the time zone, i.e. the difference between the internal UTC and the local time, needs to be adapted.



B2 Installation

System Requirements

- Windows from version 7 and Server 2008 R2 respectively
- PC with a free PCIe slot
- Internet access
- Real-time coupled LTC generator, e.g. Plura Rubidium GT

Additionally, to the real-time coupled time of the LTC, it is possible to use the date and/or the receiving state of the real-time receiver.

Downloading the Software

Two software packages are needed to operate the PCIe TS board: the device driver and the PCI TS software. Both can be downloaded from here:

<https://www.plurainc.com>

Navigate to “Timing Solutions / Timecode PCI cards / Software Tools” and download two files:

- “AV TimeSys: PC System Clock Synchronization with PCI TS” and
- “Driver for PCI and PCIe”.

Both are ZIP files and have to be unzipped before use.

Mounting of PCIe Board

SW1 of the PCIe TS board serves to determine whether the LTC will be connected balanced (off) or unbalanced (on). For details please refer to chapter “PCIe TS Board”.

To mount the board, shut down Windows, switch off the PC and plug the PCIe TS board to a free PCIe slot. Connect the real-time coupled LTC, then switch on the PC again.

Installing the Device Driver

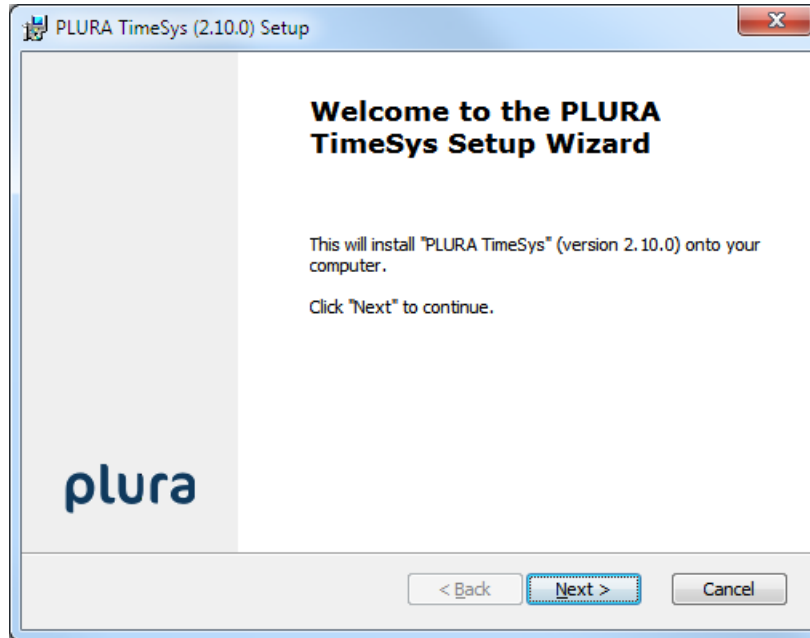
The PCIe TS board will be detected by the operating system at startup. Log on as administrator, thereafter Windows will request a driver. Point the wizard to the folder where the downloaded device driver was unzipped and install the “PCI TS” device driver by completing the wizard.

To finish driver installation run the file “Install Driver.bat” from the device driver folder.

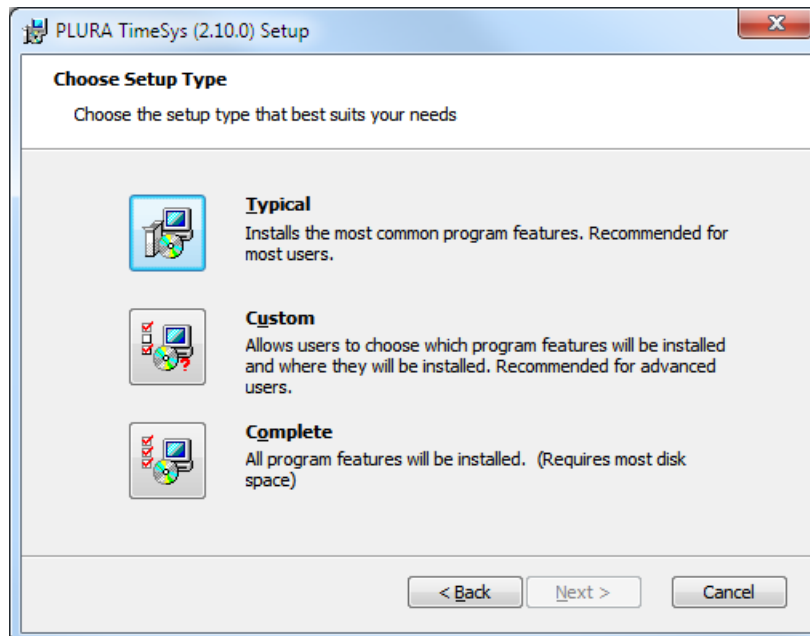


Installing the Program

Log on as administrator, go to the folder where the PCI TS software was unzipped and run "TimeSys.msi". You'll be guided through the installation:

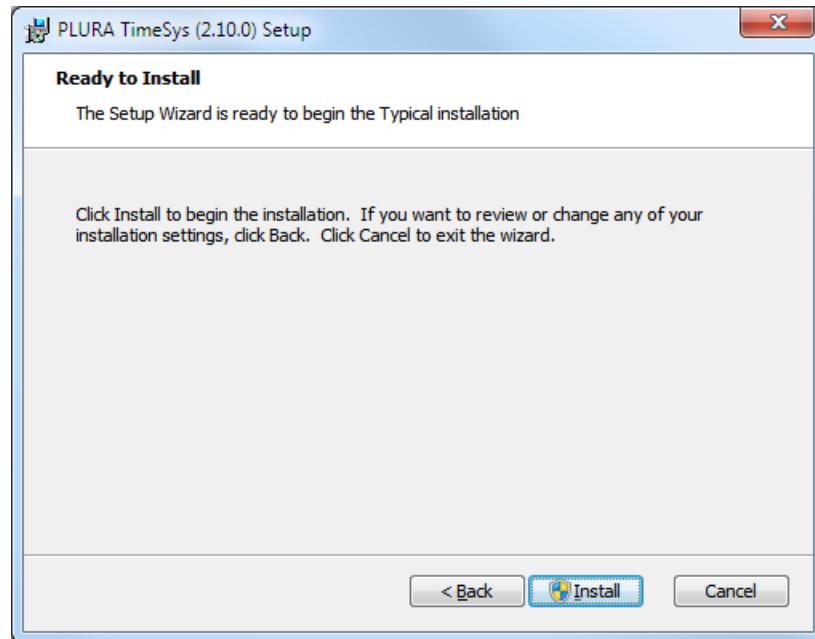


Click "Next".



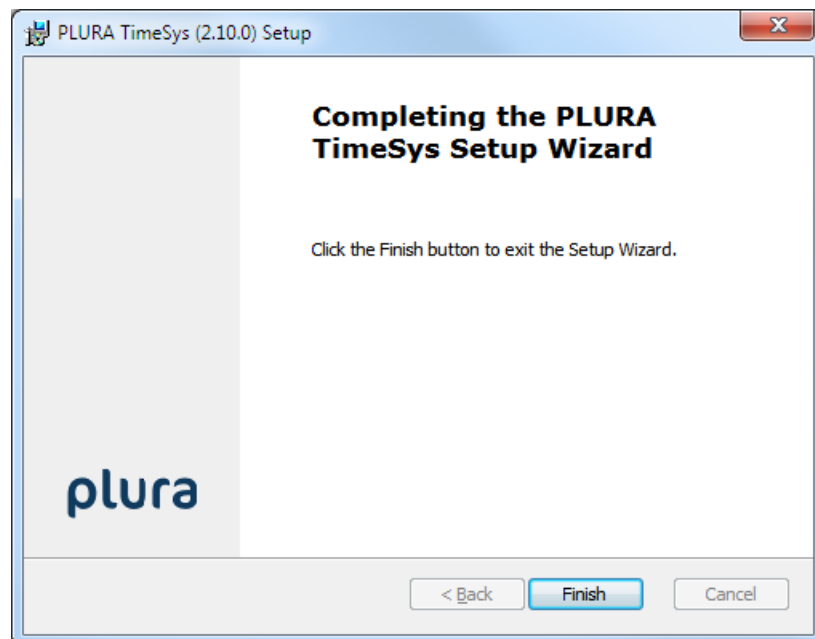
Click "Typical". The software will install to "C:\Program Files\Plura\TimeSys". If you want to install it to another folder click to "Custom" and browse to that folder.





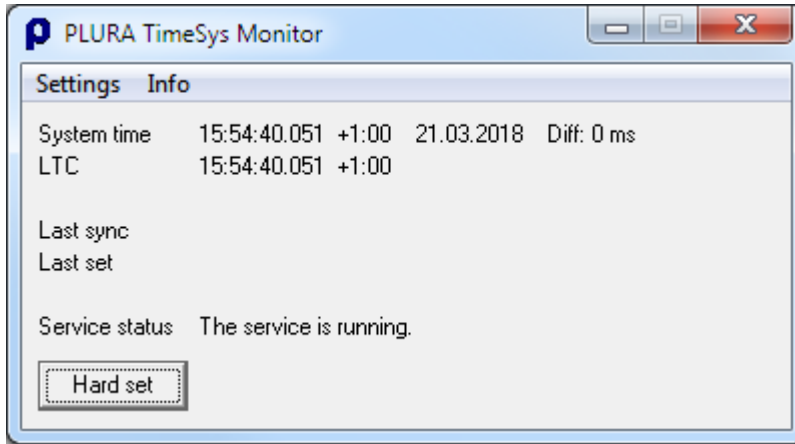
Click "Install". A security warning message appears, please confirm that the software was signed by Plura Europe GmbH and click "Yes".

At the end of the installation you should see this screen:



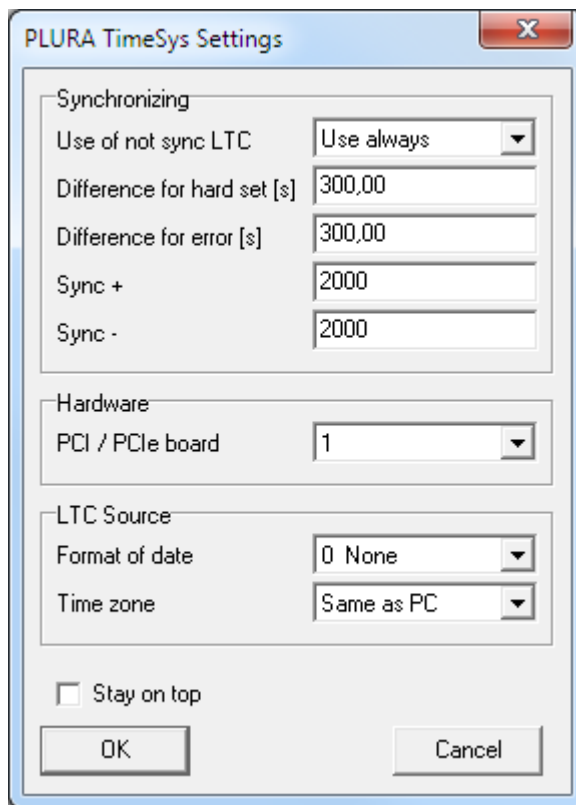
Click "Finish" and run "Start / All Programs / Plura / TimeSys Monitor". It requests Administrator rights and the "Plura TimeSys Monitor" will be shown:





Check the “Service status” message. If it is not “The service is running” then most likely the PCIe TS board was not found. This may happen if more than one Plura PCL boards are installed to the PC, in this case the hardware address needs to be adjusted and the service started manually.

Click “Settings”.



The PCIe TS board can be selected with “Hardware / LTC board base address”. If the PCIe TS is the only PCL board installed, this parameter is always 1. Otherwise the board can be selected here but then the TimeSys service needs to be started manually, see chapter “Plura TimeSys Service”.

The other parameters may be set at a later time, for details please refer to chapter “Monitor Program / Settings”. Click “OK” to save the settings and close the window.



Time Zone and Daylight-Saving Time Changes

The internal time of Windows runs in UTC. To have the local time displayed, ensure that the time zone is set correctly and that the change-over of daylight-saving time is working. "Plura TimeSys" modifies neither the time zone nor the information for daylight saving time, since this is managed by Windows itself.

Starting the Program

The "Plura TimeSys" service is now integrated in Windows. It will be started automatically every time Windows starts, irrelevant whether you are logged on or not. Additionally, a start menu item was made available in "Start / All Programs / Plura / TimeSys Monitor". It starts the monitor program which serves to monitor and set-up the "Plura TimeSys" service.

Update

If you get a new version of the program, simply install it over the existing installation as described above. The old program will be uninstalled first automatically. All settings will be preserved.

Uninstall

To uninstall the program, execute the following steps:

- Quit the "Plura TimeSys" monitor program.
- Run "Uninstall a program" from "Start / Control Panel", select "Plura TimeSys" and click on "Uninstall". Respond to the inquiry whether you wish to remove this application by clicking on "Yes". Now the TimeSys software will be removed.

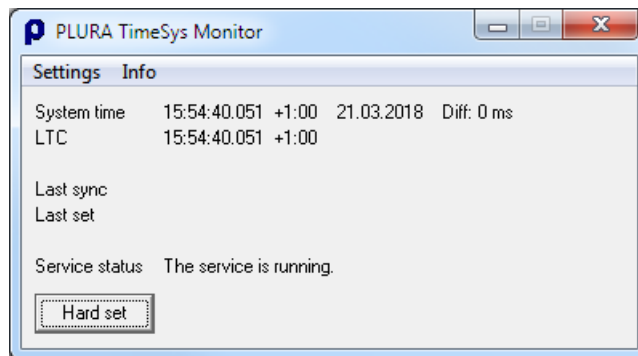


B3 Monitor Program

The monitor program serves to monitor the “Plura TimeSys” service and to adapt this service to the individual requirements.

Starting the Program

Run the monitor program with “Start / All Programs / Plura / TimeSys Monitor”. It requests Administrator rights and the monitor window opens:



The following information will be shown:

- “System time”: The current system time of Windows. Time, difference to UTC in hours, date and difference to LTC in milliseconds are shown. The display refreshes every second.
- “LTC”: Readout LTC. Time, difference to UTC in hours, date and sync status (“Sync” or “Not sync”). The display refreshes every second. Some information’s may be not shown if they are not provided by the LTC source. The display refreshes every second.
- “Last sync”: The point of time at which the LTC has last supplied the status “synchronous”. Time, difference to UTC in hours and date are shown. Depending on the LTC source, it may e.g. be seen whether a connected DCF or GPS receiver receives a valid antenna signal. If this time stands still, the status “synchronous” has not been detected since the shown time. This display refreshes about every 3rd second.
- “Last set”: The last point of time at which Windows system time was hard set last. The following data are shown: Time, difference to UTC in hours, date and difference to LTC in milliseconds, which had been readjusted by this hard set.
- “Service status”: The status of the “Plura TimeSys” service. “The service is running” indicates that the “Plura TimeSys” service was started correctly and is now running in the background. Other messages will supply indications of possible errors in the communication between the monitor program and the “Plura TimeSys” service.

Operation

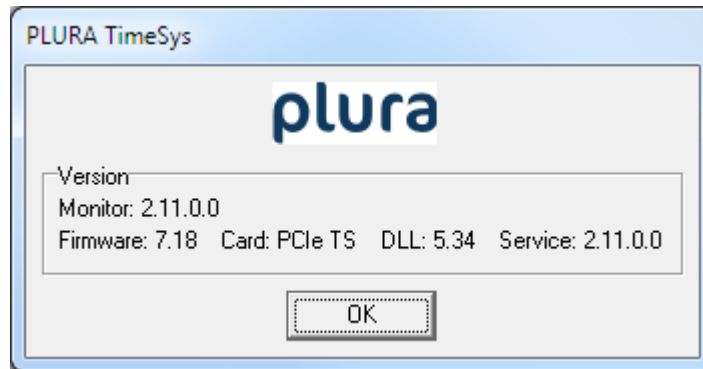
- “Hard set” sets the Windows system time hard on the LTC. This may be useful if LTC and system time differ quite considerably, so the system time needs to be synchronized once with the LTC. If the LTC source is providing date information, the system date will be set beside the time.



The Windows system produces a difference of 70ms approx. between the system time and the LTC following a hard setting. This difference is then readjusted by the adjusting algorithm.

The time between clicking on the button and the return from the "Plura TimeSys" service may last up to 10 seconds.

- "Info" shows the revision of program and PCIe TS board:



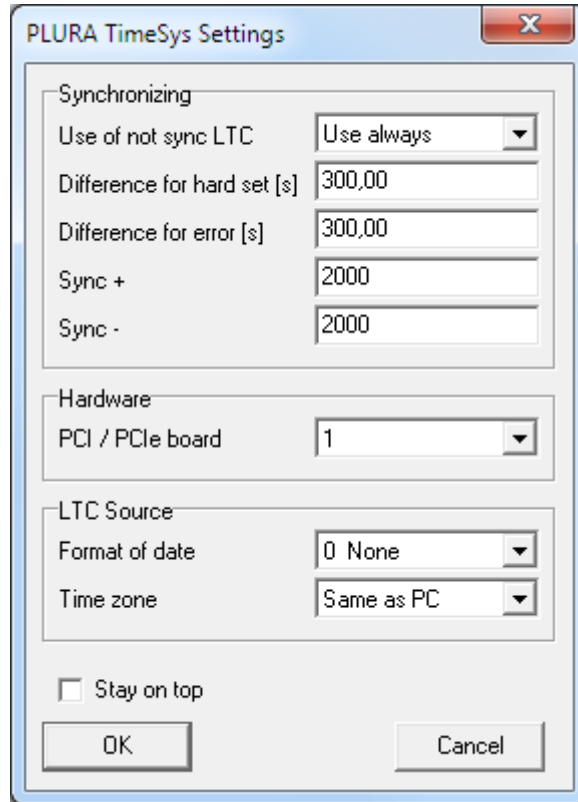
The following revision numbers will be shown:

- "Monitor": The revision of the monitor program.
- "Firmware": The revision of the firmware ROM of the PCIe TS board.
- "DLL": The revision of the kernel mode driver which carries out the communication with the PCIe TS board.
- "Service": The revision of the "Plura TimeSys" service.



Settings

“Settings” provides a dialog box to configure the “Plura TimeSys” service and the monitor program:



- “Use of not sync LTC”: How to use an LTC which has not been marked by the generator as being synchronous to the real time, or if there is no information about that available. There are three ways for the “Plura TimeSys” service to react:
 - “Use always” accepts the LTC at all events, irrespective of having been marked as being synchronous or not.
 - “Use if once sync” waits from the start of the system until the LTC will be once marked as being synchronous. Then, the LTC will always be accepted, even if it was marked occasionally as being not synchronous, e.g. due to reception problems. Having selected this setting, the LTC generator is expected to be more stable than the system time even in the free run mode.
 - “Use never” accepts the LTC only if it was marked as being synchronous. If not, no readjustment will be made for a while.
- “Difference for hard set”: The difference between system time and LTC which will produce a hard set on the LTC. This value can be entered with an accuracy of 1/100 seconds. Any difference below this value will be readjusted by moderating or accelerating, respectively the system time. By setting this value 0.00 no hard set will be made, any differences will then be readjusted.

Such setting is of special importance in the event of leap seconds. If such differences shall be readjusted, the value has to be set 0.00 or to 1.20 minimum; shall they produce a hard set of the system time, select a value within 0.50 and 0.80.



Please note: Do not set values less than 0.5 seconds. If the system time is hard set, a difference of some ms occurs, which will then be readjusted. This difference is produced by the Windows system. If the selected value is too low, this difference might cause a hard set, which will cause another hard set, etc.

- “Difference for error”: The difference between the system time and the LTC in seconds, from which on the LTC will be rejected as not plausible. If system time and LTC have been synchronized once (e.g. with the “Hard set” button), no considerable differences between these two times will occur during continuous operation. If the PC is switched off, the system time will continue counting battery-powered with an accuracy of 10^{-5} to 10^{-4} approx. This way a difference will accumulate, up to a maximum of 9 seconds per day, depending on the circumstances. Please take this into consideration when setting the difference. Differences above this setting may hint at a faulty LTC. Hence, this setting serves to detect such faults. If every LTC shall be accepted, this error detection may be disabled by setting 0.00.
- “Sync +”, “Sync -”: The adjusting speed to accelerate (Sync +) or moderate (Sync -) the system clock. A setting of 2000 effects an adjustment of approximately 20ms per second. A difference of one second (1000ms) will be readjusted within $1000ms / 20ms = 50$ seconds. The higher the values, the faster the system clock will catch up with the LTC.
- “LTC board base address”: If more than one PCL board is installed, the PCIe TS board can be selected here. If the PCIe TS is the only PCL board installed, this parameter is always 1.
- “Format of date”: Beside the time, date information from the LTC can be used. To do this, the format of the date has to be defined:

Format	User bits	Date	State	Time zone
0 None	Not used			
1 MTD	MTD	X	X	X
2 Date	User = XX DD MM YY	X		
3 Status	User = SS DD MM YY	X	X	X
4 EBU I29	User = EBU Tech. I29-1995 (BBC)	X		
5 Date-2	User = DD MM YYYY	X		
6 Date-3	User = YY MM DD XX	X		
7 Date-4	User = XX YY MM DD	X		
8 Date-5	User = X YY MM DD X	X		
9 Date-6	User = DD MM YY XX	X		

Meaning of symbols: SS = state, DD = day, MM = month, YY two-digit year, YYYY = four digit year, X = unused. The format number is the same as the user mode of the Plura LTC generator Rubidium GT.

- “Time zone”: The LTC source does not necessary has been generated in the same time zone the PC is running in. It is possible to have the PC running in Central Europe Time (CET, with daylight saving time switching), but the LTC running in UTC. The setting “Time zone” specifies how to handle time zones:
 - “From LTC Status”: The time zone information is read from the LTC. This is only possible in date formats 1 and 3.
 - “Same as PC”: The LTC is running in the same time zone as the PC. That means that the LTC does the same daylight switching as the PC.
 - “UTC”: The LTC is running in UTC.



After changing this setting, it is possible that for some seconds some error messages are generated by the "Plura TimeSys" service.

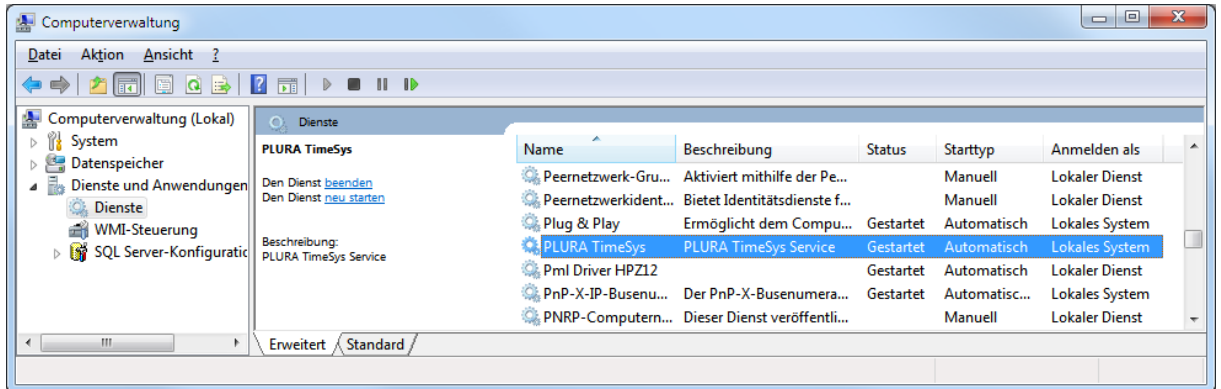
- "Stay on top": Selection whether the monitor program shall appear in front of the other windows or be covered by them.

"OK" will transfer the new settings to the "Plura TimeSys" service. It may take up to 10 seconds time until a new setting becomes effective. "Cancel" will close the window without storing any changes.



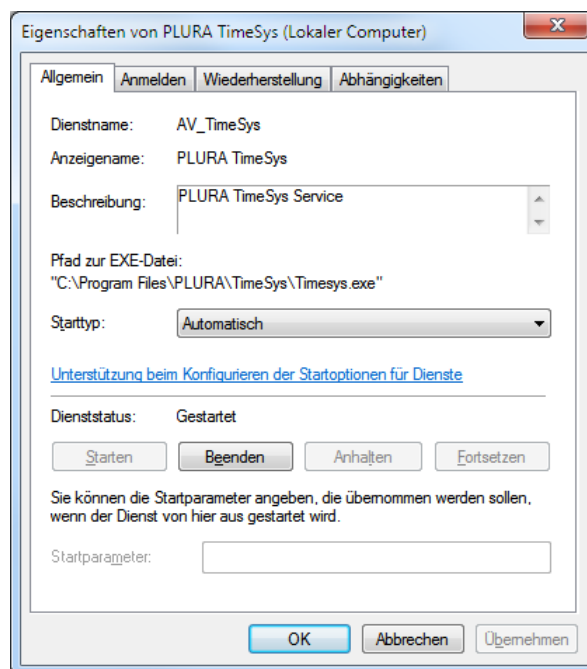
B4 Plura TimeSys Service

The Plura TimeSys service is installed by the setup program, i.e. the service will be started automatically with every system start. This setting may be changed with the Services Manager of Windows. You'll find it in the computer management console:



Here, e.g. click on "Stop" to manually disable the "Plura TimeSys" service.

With double-click to the service name the properties can be opened where the "Startup Type" can be set to determine whether the "Plura TimeSys" service shall be started with every system setup automatically:

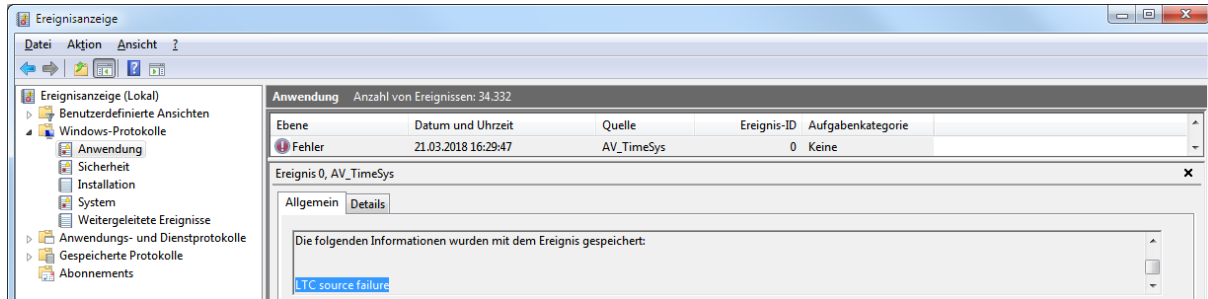


The preset selection is "Automatic". With selection "Manual", the "Plura TimeSys" service has to be started manually via the Services Manager after every system start. For detailed information on the service management please refer to your Windows documentation.



B5 Messages

These messages will be logged in the application event log. They may be shown in the computer management console:



In this example the LTC source has failed ("LTC source failure"). For details on the event log settings please refer to the Windows documentation. The following messages may occur:

- "System Time is hard set": The system time was hard set, either by using the "Hard set" button in the monitor program, or because the difference between the system time and the LTC exceeded the value (in seconds) set in "Settings / Difference for hard set". The shown difference (in milliseconds) was compensated.
- "LTC is out of limits": The LTC was rejected as being invalid, because the difference between system time and the LTC exceeded the value (in seconds) set in "Settings / Difference for hard set" in seconds. As soon as this difference falls below the limit, the "Plura TimeSys" service automatically starts the readjustment. The other possibility is to have the system time hard set by pressing the "Hard set" button.
- "LTC source failure": The PCIe TS board fails to read a valid LTC. An LTC generated at normal play speed is required. Please check the connections and the position set at SW3.4, which serves to switch between balanced and unbalanced LTC.
- "LTC user data format error": The user bits of the LTC fail to contain valid status information. To have the system time readjusted by the "Plura TimeSys" service, the settings "Format of date" and "Time zone" have to accord with the format of the connected LTC source.
- "Can't open Plura TimeSys service": The monitor program was started but failed to open the "Plura TimeSys" service. To eliminate this fault, the service may be re-installed with "Plura TimeSys Install" from "Start / Programs / Plura PCI TS".
- "Hardware not found": No PCIe TS board was found at the given base address. Possible reasons can be a wrong address or overlaps with other boards. Please check SW1 of the PCIe TS board and "Settings / LTC board base address" in the monitor program.



B6 Timecode Reader Boards

PCIe TS

PCIe TS is a PCI Express board for PCIe x1 bus and is equipped with an LTC time code reader.

Inputs

Pin	Signal
3	LTC Input LTC-1
6	LTC Input LTC-2
4	LTC GND

Connector: RJ45

Signal Description
LTC input, balanced or unbalanced 100 mV _{pp} to 5 V _{pp} , impedance 47 k Frame rates: 25/30/30Drop, auto-detect Frequency: nominal "play" speed ± 1% Direction, time addresses: "forward", time information has to be up-counting without discontinuities.

Switches

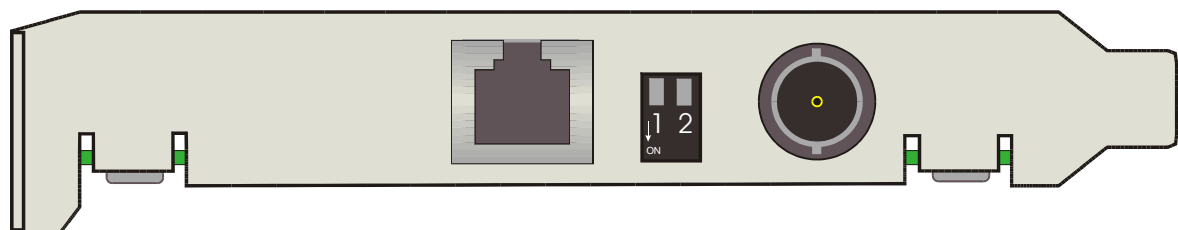
SW1	LTC Input
ON	Unbalanced LTC input at LTC-2
OFF	Balanced LTC input at LTC-1 and LTC-2

SW2	Not used
ON	
OFF	

Others

Dimensions over all (Length x Height x Width)	191 x 120 x 22 mm (standard profile slot) 191 x 80 x 22 mm (low profile slot)
Weight	≈ 80 g
Operating voltage	3.3 VDC and 12 VDC
Power consumption	3 W
Ambient temperature	5 – 40 °C
Relative humidity	35 – 85 %

Connections



LTC SW1 SW2 BNC (not used)



PCI TS

The Plura TimeSys software also works with the discontinued PCI TS board. It is a PCI board for the 32 bit/33 MHz (3,3V/5V) PCI bus and is equipped with an LTC time code reader.

Inputs

Input	Connector	Signal Description
LTC-1 LTC-2	2 x RCA jack	LTC input, balanced or unbalanced 100 mV _{pp} to 5 V _{pp} , impedance 47 k Frame rates: 25/30/30Drop, auto-detect Frequency: nominal "play" speed ± 1% Direction, time addresses: "forward", time information has to be up-counting without discontinuities.

Switches

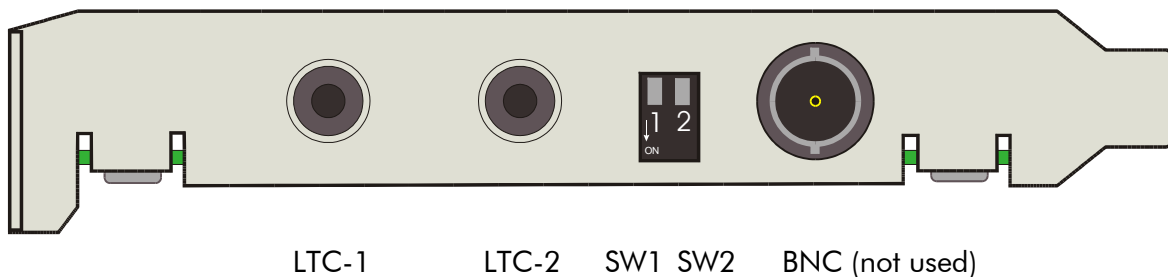
SW1	LTC Input
ON	Unbalanced LTC input at LTC-2
OFF	Balanced LTC input at LTC-1 and LTC-2

SW2	Not used
ON	
OFF	

Others

Dimensions over all (Length x Height x Width)	141 x 120 x 22 mm
Weight	≈ 110 g
Operating voltage	3.3 VDC and 5 VDC
Power consumption	2 W
Ambient temperature	5 – 40 °C
Relative humidity	35 – 85 %

Connections





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