

Identification & Repair of USB-Streaming Timing and Drop Out Issues

TN04

Technical Note for the KLIPPEL R&D and QC SYSTEM (Document Revision 3.2)

USB audio streaming demands critical and special settings of the operating system and the hardware. This document lists important requirements and helps identifying timing and drop out issues. It starts with a checklist of recommended settings. Background information for deeper searches are given in the appendix.

QUICK-START CHECK LIST

Some commands have a shortcut command (cmd is the command line prompt). Open the start menu and enter "cmd". The command itself is **shown with black background**.

Instruction	<input checked="" type="checkbox"/>
Are you using the certified USB cable delivered by KLIPPEL?	<input type="checkbox"/>
Are USB ports connected directly to the motherboard? Front USB ports are usually not directly connected.	<input type="checkbox"/>
Is the USB cable directly connected to the PC (without a USB hub and without extension cord)?	<input type="checkbox"/>
Try other USB ports.	<input type="checkbox"/>
Try other USB cables (KLOTZ USB cable certified by KLIPPEL).	<input type="checkbox"/>
Disable all WiFi and Bluetooth hardware.	<input type="checkbox"/>
Unplug any USB devices that are not necessary for the Klippel measurement system.	<input type="checkbox"/>
Open power options (cmd: control powercfg.cpl,1,1), verify: (Options are automatically set for the <i>Klippel High Power Streaming</i> energy schema during the installation)	
<i>Klippel High Power Streaming is active</i>	<input type="checkbox"/>
<i>Hard disk: Turn off hard disk after is set to Never</i>	<input type="checkbox"/>
<i>USB settings: USB selective suspend setting is set to Disabled</i>	<input type="checkbox"/>
<i>PCI Express: Link State Power Management is set to Off</i>	<input type="checkbox"/>
<i>Display: Turn off display after is set to Never</i>	<input type="checkbox"/>
<i>Processor power management: Minimum processor state is set to 100%</i>	<input type="checkbox"/>
<i>Sleep: Sleep after is set to Never</i>	<input type="checkbox"/>
<i>Sleep: Allow hybrid sleep is set to Off</i>	<input type="checkbox"/>
<i>Sleep: Hibernate after is set to Never</i>	<input type="checkbox"/>
Open power options (cmd as admin: hdwwiz.cpl devmgmt.msc): <i>USB Serial Bus Controllers</i> , open the properties of every <i>USB Hub</i> and <i>USB Root Hub</i> , open the <i>Power Management</i> tab and verify that all options are unchecked.	<input type="checkbox"/>
Open the <i>Advanced</i> system properties (cmd as admin: SystemPropertiesAdvanced): section <i>Performance: Settings...</i> In the new window (<i>Performance Options</i>) tab <i>Advanced</i> in section <i>Processor scheduling</i> , verify that <i>Background services</i> is selected.	<input type="checkbox"/>
Re-install the USB audio driver for the KA3 (see Appendix section 1.10 for detailed information)	<input type="checkbox"/>
Check for Windows Updates (check with your administrator)	<input type="checkbox"/>
Update all drivers and BIOS (check with your administrator)	<input type="checkbox"/>

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1 Diagnostics in Detail

A typical symptom for Windows OSs related problems is that the occurrence of a problem is relatively well correlated with time. For example drop out errors occurring always at the same time of the day or week.

1.1 Manual

Please check the manual chapter *dB-Lab Software > Malfunction and Troubleshooting > USB Connection*. The Manual section provides the following information:

- Symptoms in R&D and QC
- Requirements for a reliable USB streaming performance
- Incompatible devices and device drivers
- Klippel Performance Test
- Klippel USB Driver problems
- How to report errors and request support.

These parts are not discussed here, so please refer to the explanations in the described manual section.

1.2 Klippel Performance Test Tool

The performance test will be started during the dB-Lab Setup. To start it manually choose:

- QC Installation: QC-Start / Tools / Performance Check
The quick test was enforced during installation, a double check is recommended.
- R&D Installation: dB-Lab / Tools / Performance Test
Start with the Quick Test Mode for 10 minutes for a first glance.

The use of the Klippel Performance Test is recommended for at least 4h to check symptoms thoroughly, better run it overnight.

Sampling Rate

The likelihood of drop outs may depend on the sampling rate. The test mode "Check all Sampling rates" will cycle thru all rates. This test is recommended if problems occur frequently after changes of sampling rates.

ASIO Buffer Size

The likelihood of drop outs and also the audio connection to the Klippel hardware is affected by the ASIO buffer size settings. This buffer is set to a stable value for most systems. However, rarely this setting can cause problems. By default 36 ms are used, you may use 48 / 64 ms or also smaller sizes as 24 ms. The stability of various ASIO settings shall be checked using the Performance Test Tool mode "Test all buffer sizes". If you use an R&D system and run into problems specific with 36ms buffer size please contact the Klippel support.

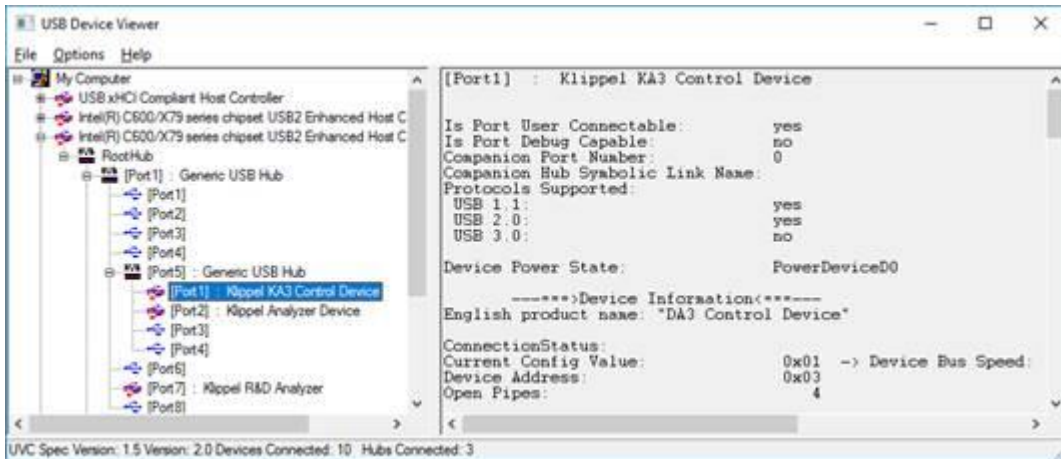
Manual

The manual (*dB-Lab Software > Malfunction and Troubleshooting > USB Connection*) describes details of the Klippel Performance Test Tool.

1.3 USBVIEW

USBVIEW is a 3rd party tool that checks for connected USB devices. It can list devices even if no driver is installed for the device. This helps you diagnose low level connectivity problems (such as faulty USB hubs, cables or PC USB ports).

In dB-Lab open *Tools / USBVIEW*, in Windows start menu, enter *USBVIEW*.



You will see all USB devices connected to your computer.

Check if the device (KA3, PA) you are looking for is listed (you can dis- and reconnect to make sure it's the device you are looking for)

Does USBVIEW indicate an error for the device?

Note: USBVIEW may show the following warnings that do not prevent proper function and can be safely ignored:

- *!* ERROR: No Open Pipes
- *!* ERROR: Bit 7 is reserved and must be set

If the device is not listed here, listed with significant errors, or dis- and reappears here:

- Switch to another USB connection.
- Use a port that is connected to a different Host Controller.
- Switch the device off and on again.
- Remove USB Hubs in the connection path.
- Use another certified USB cable.

1.4 Latency Check Tool

QC-System: Included in installation. Start it: QC-Start / Tools / Latency Check

R&D-System: Download from: http://www.thesycon.de/eng/latency_check.shtml

Make sure it is not showing sporadic peaks (red bars). Run it for at least 1h and check the "Absolute Maximum time" at the bottom of the application.

Note that the tool does NOT WORK on windows 8 and windows 10 correctly. The manufacturer of the software states:

The DPC latency utility runs on Windows 8 but does not show correct values. The output suggests that the Windows 8 kernel performs badly and introduces a constant latency of one millisecond, which is not the case in practice. DPCs in the Windows 8 kernel behave identical to Windows 7. The utility produces incorrect results because the implementation of kernel timers has changed in Windows 8, which causes a side effect with the measuring algorithm used by the utility. Thesycon is working on a new version of the DPC latency utility and will make it available on this site as soon as it is finished. http://www.thesycon.de/eng/latency_check.shtml

1.5 QC Endurance Test Tool

QC Endurance test tool is a dedicated tool to analyse real QC tests on a long term basis. It is described in TecNote *TN06 - QC Endurance Test*. This tool reveals systematic or sporadic timing issues. It requires a drop out free operation, thus it shall be used at the end of drop out analysis and fixes.

Before using the QC-System on automated lines, this tool shall be used to assess the distribution of measurement time and analysis.

This test may also be used for stability of long, automatic test sequences

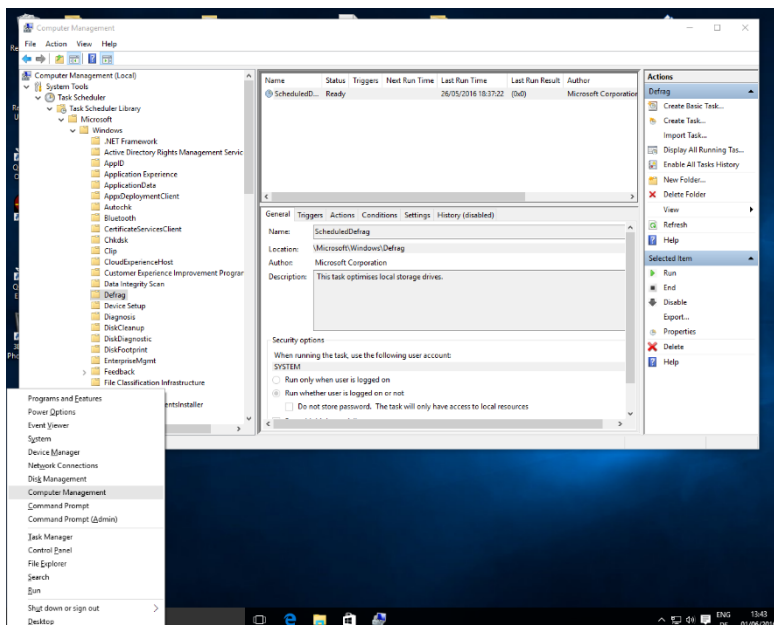
1.6 Windows Maintenance Tasks

Windows usually performs several maintenance tasks every day. We found out, that these tasks may affect the audio streaming stability and performance in critical situations. Please make sure that these tasks won't run in time critical measurement-environments.

The most well-known tasks, which affect the performance, are:

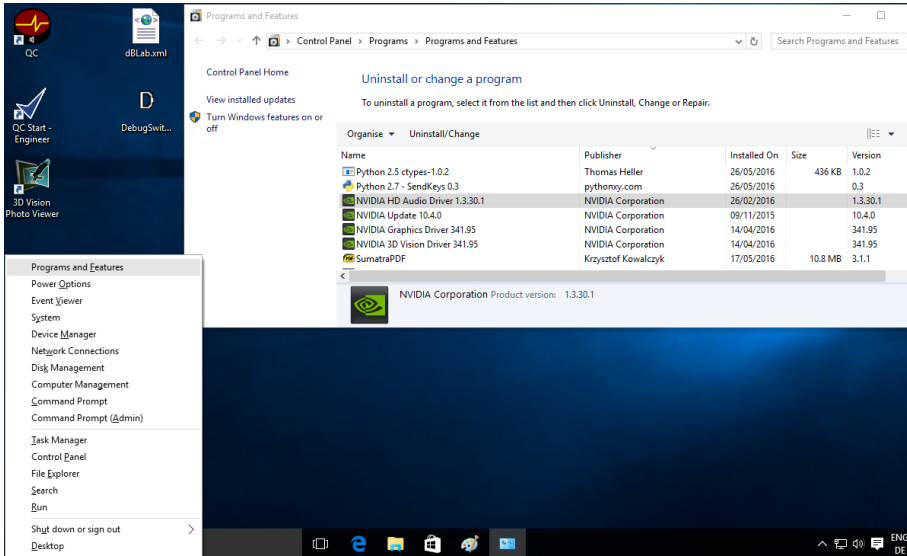
- Windows updates of any kind
- Creation of System-Restore-Points (usually created during software and windows-updates)
- Defragmentation of hard discs
- Windows-Defender and other antivirus update and scanning-processes

You can check the schedules for these tasks in the MS Windows task-planner which can be found in *Control Panel* -> *Administration* -> *Task..* In Windows 10 you easily reach the Administrative Menu by pressing Windows-Key + "x", then select "Computer Management" and expand the tree *System Tools – Task Scheduler – Task Scheduler Library – Microsoft – Windows...* Check if there were maintenance tasks running when you experienced some errors or drop-outs. If you can match some tasks with these problems you may disable some of these tasks or change the "next run time" to more uncritical time slots.



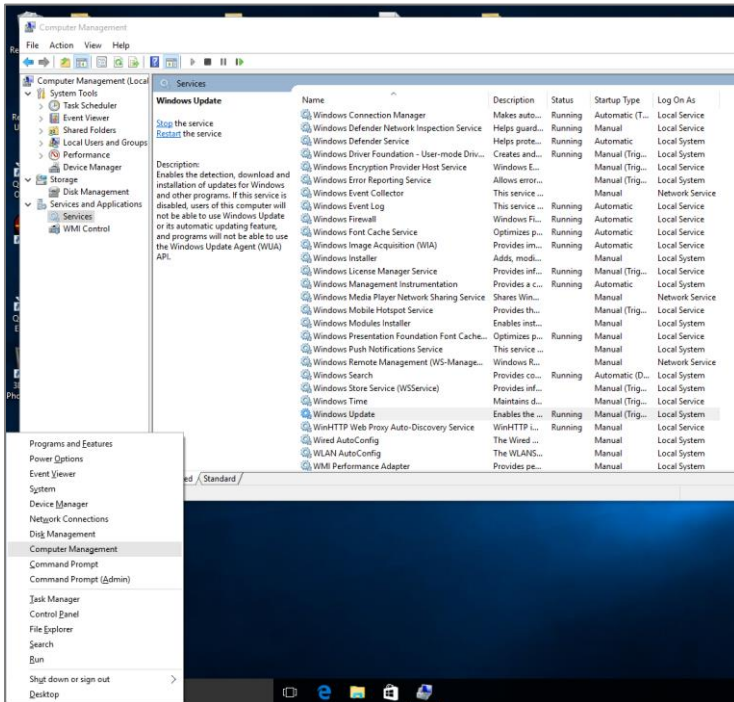
1.7 Driver Issues

Issues with dropouts in measurements, mostly during login or start processes or shortly after those, have been observed in case certain **Nvidia**-System drivers are installed on the system. The phenomenon appears to occur slightly more often if there is some graphical stress (moving, opening, closing windows), mouse action etc. Please check in Windows programs list if there are installed Nvidia drivers listed below. In Windows 10 you easily reach the *Administrative Menu* by pressing Windows-Key + "x", then select the first option "Programs and Features"



If you experience these problems in combination with installed Nvidia drivers, we advise you to remove these Nvidia system drivers from your system.

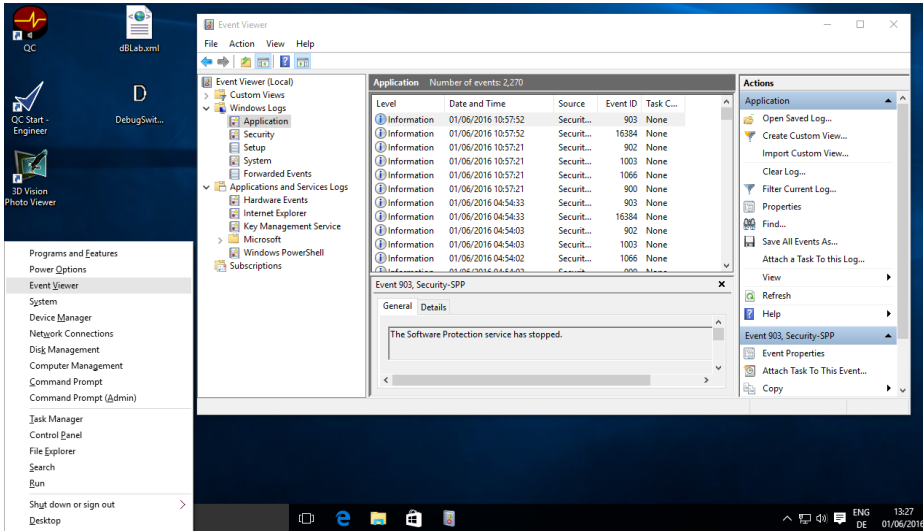
Note: Windows update mechanism may reinstall these drivers automatically. If this happens, try to deactivate automatic Windows updates. The most efficient way to do this is stopping the “Windows Update” service in “Computer Management”, “Services and Applications”. Please note that disabling Windows updates can be dangerous because by doing this you won’t get any updates anymore and possible security leaks remain unpatched. So this setting is definitely not recommended on a computer connected to the internet.



One other option may be to only use systems without Nvidia devices (usually graphic-cards) installed, so there is no risk of any possible problematic Nvidia-Drivers.

1.8 Check Windows Event Protocol

In Windows 10 you can easily access the administrative menu by pressing Windows-Key + “x”, and then select the third option “Event Viewer”. Most interesting are the folders “Application”, “Setup” and “System” of the Windows Logs. Check in these lists for entries that happened at the same time you experienced errors or drop-outs.

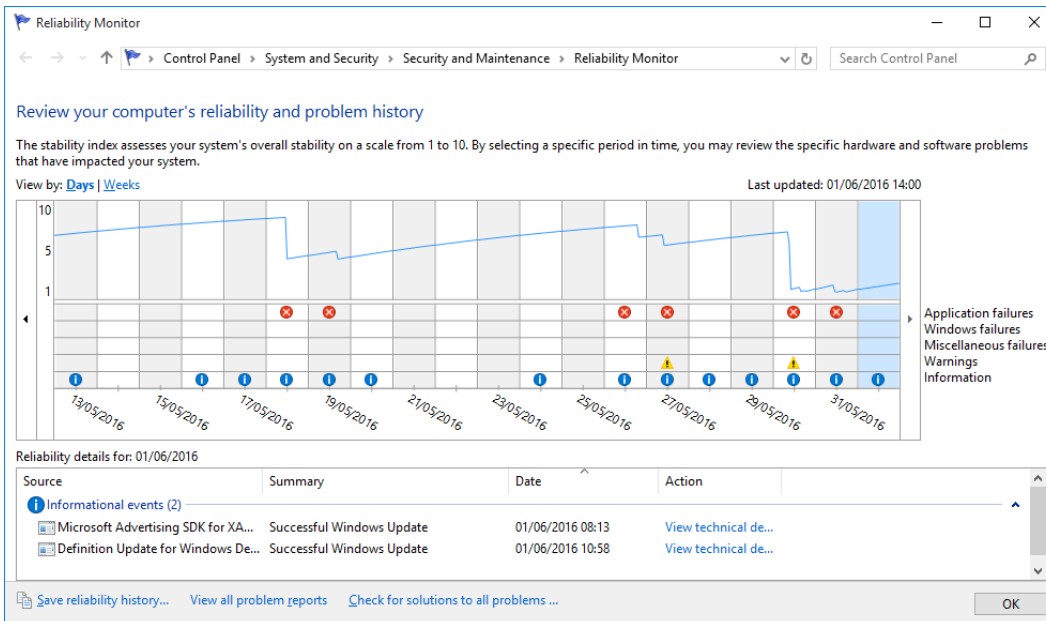


Please find more details on the event log analysis on the appendix.

1.9 Check System with Perfmon Tool / Reliability Report

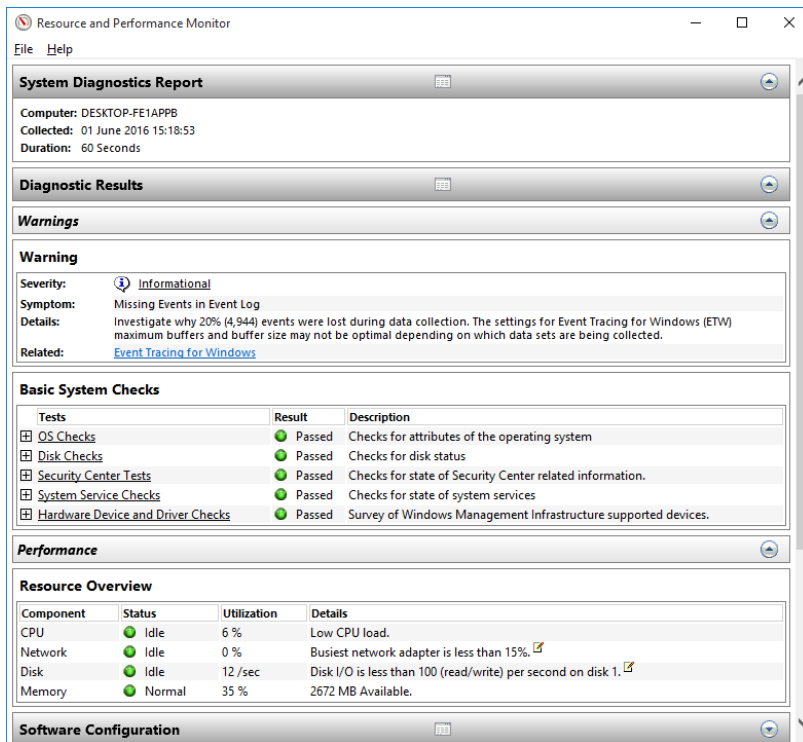
Windows provides a nice tool to monitor the system reliability versus time. In Windows Control Panel select “System and Security/Action Center” and then “Reliability Report”. The *Reliability Monitor* is part of the *Performance Monitor* Perfmon.exe.

This generates a daily report with a lot of information about crashes, warnings and much more. You may check the frequency and kind of problems in soft- and hardware (driver level).



You can directly call the program by typing the command into the search field of the Windows Start menu:

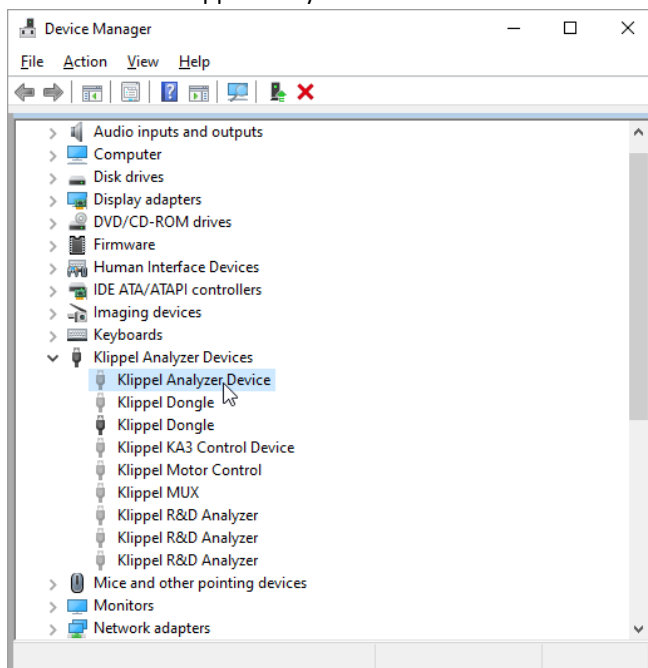
- With “perfmon / res” you can directly start the *Resource Monitor*.
- With “perfmon / sys” you can start performance monitoring in Windows.
- With the command “perfmon / report” produced the 60-second diagnostic report.



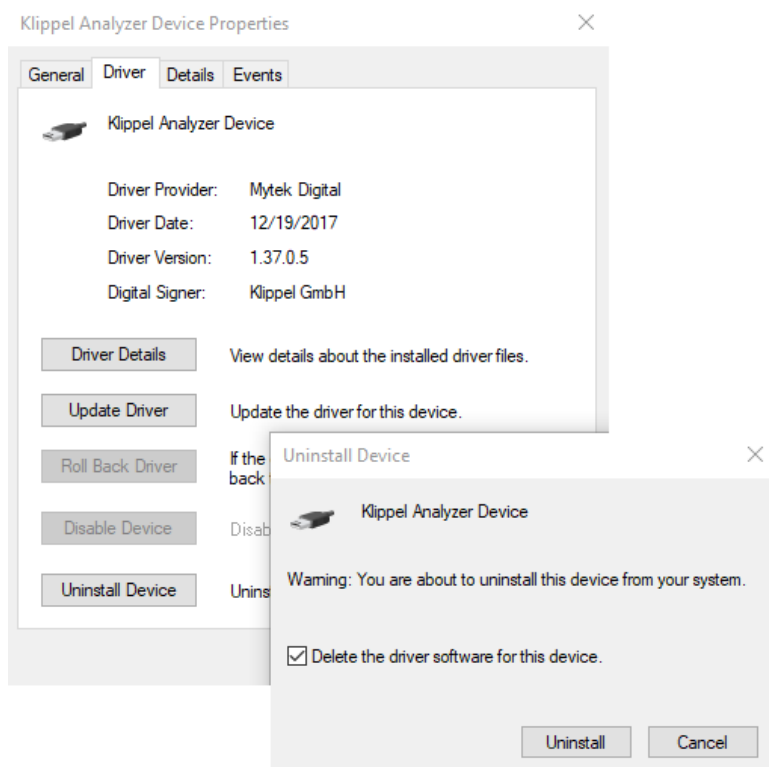
1.10 Re-install the Klippel USB driver

In some rare cases it might be that the USB audio driver has crashed and needs to be re-installed for proper operation. To do this please follow these steps:

- Disconnect the KA3 from the PC (do not re-connect it until the device driver is re-installed!)
- Open the Windows device manager and activate the option “Show hidden devices” in menu “View”.
- Search for the “Klippel Analyzer Device” in the list of devices and open its properties.



- In tab “Driver” please click the button “Uninstall Device” and activate the option “Delete the driver software for this device” in the next dialog.



- After uninstalling the device driver, please reboot the PC!
- Run the USB driver setup manually.
(it is normally located here: C:\Program Files (x86)\Klippel\RnD\Driver\USB Audio\setup.exe)
- During the installation of the USB driver you have to reboot the PC again. Please manually start the driver installation again after rebooting.
- When the USB driver is installed completely, please re-connect the KA3 to the PC. It should work without problems now.

1.11 Check with New Operating System / BIOS update

In case of persistent trouble on a PC fulfilling Klippel PC spec, use fresh windows installation best first without network connection (avoid any internet updates) and check again.

Additionally, please update the BIOS to the latest version and check again.

1.12 Windows XP Related Issues

Applicable to QC-Installation only:

Windows XP is supported for QC1-QC5 only.

Under Windows XP the **Klippel USB driver 1.37.x** may not working reliably!

In case blue screens appear and they are caused by the USB Klippel driver (**Klippel*.sys**) use Klippel USB driver 1.35 instead.

Please report such problems to qc-support@klippel.de.

2 Getting Deeper Information

2.1 Background Information: Why Drop-Outs Occur

(from http://www.thesycon.de/eng/latency_check.shtml)

Processing of streaming data in real-time is a very challenging task for Windows based applications and device drivers. This is because by design Windows is not a real-time operating system. There is no guarantee that certain (periodic) actions can be executed in a timely manner.

Audio or video data streams transferred from or to an external device are typically handled by a kernel-mode device driver. Data processing in such device drivers is interrupt-driven. Typically, the external hardware periodically issues interrupts to request the driver to transfer the next block of data. In Windows NT based systems (Windows 2000 and better) there is a specific interrupt handling mechanism. A device driver cannot process data immediately in its interrupt routine. It has to schedule a Deferred Procedure Call (DPC), which is basically is a callback routine that will be called by the operating system as soon as possible. Any data transfer performed by the device driver takes place in the context of this callback routine, named DPC for short.

The operating system maintains DPCs scheduled by device drivers in a queue. There is one DPC queue per CPU available in the system. At certain points the kernel checks the DPC queue and if no interrupt is to be processed and no DPC is currently running the first DPC will be un-queued and executed. DPC queue processing happens before the dispatcher selects a thread and assigns the CPU to it. So, a Deferred Procedure Call has a higher priority than any thread in the system.

Note that the Deferred Procedure Call concept exists in kernel mode only. Any user-mode code (Windows applications) runs in the context of a thread. Threads are managed and scheduled for execution by the dispatcher.

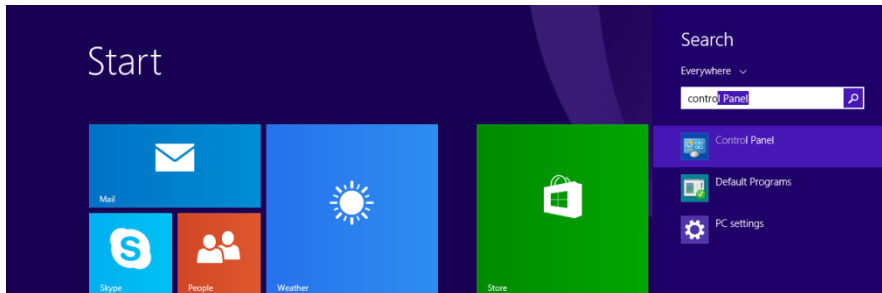
While there is a pre-emptive multitasking for threads, DPCs are executed sequentially according to the first in, first out nature of a DPC queue. Thus, a sort of cooperative multitasking scheme exists for Deferred Procedure Calls. If any DPC runs for an excessive amount of time then other DPCs will be delayed by that amount of time. Consequently, the latency of a particular DPC is defined as the sum of the execution time of all DPCs queued in front of that DPC. In order to achieve reasonable DPC latencies, in the Windows Device Driver Kit (DDK) documentation Microsoft recommends returning from a DPC routine as quickly as possible. Any lengthy operation, specifically loops, that wait for a hardware state change (polling) are strongly discouraged.

Unfortunately, many existing device drivers do not conform to this advice. Such drivers spend an excessive amount of time in their DPC routines, causing an exceptional large latency for any other driver's DPCs. For a device driver that handles data streams in real-time it is crucial that a DPC scheduled from its interrupt routine is executed before the hardware issues the next interrupt. If the DPC is delayed and runs after the next interrupt occurred, typically a hardware buffer overrun occurs and the flow of data is interrupted. A drop-out occurs.

2.2 How to View Event Logs

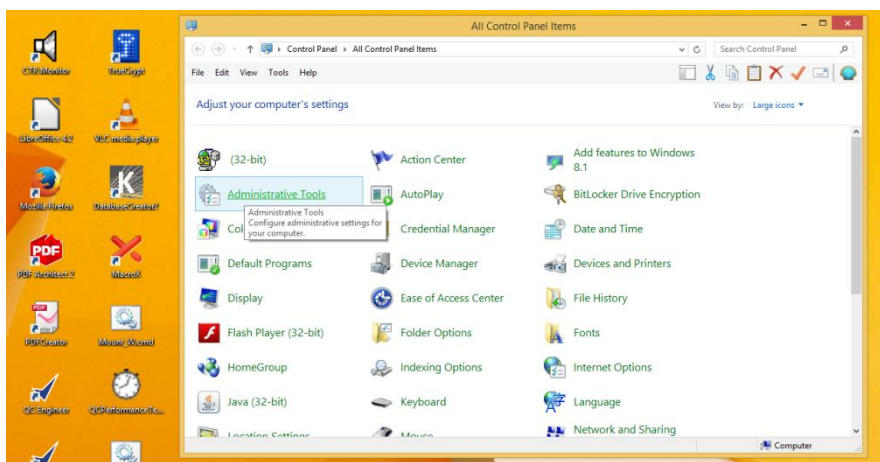
To open *Event Viewer*, follow these steps:

If you are running Windows 8 start typing “control panel” on your keyboard – the search-window will open automatically and you can select the “control panel” from the results list

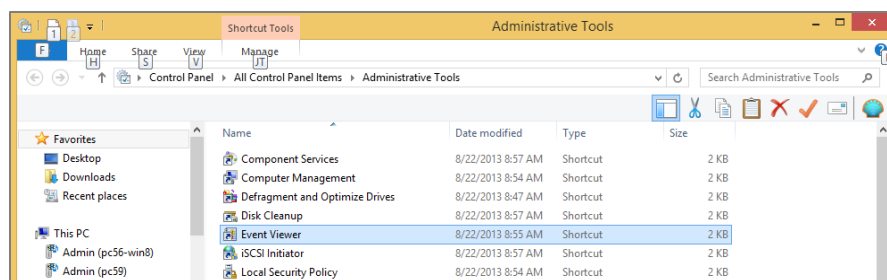


On Windows XP/Vista/7:

Open the Windows-Start-Menu by clicking **Start**, and then click **Control Panel**.

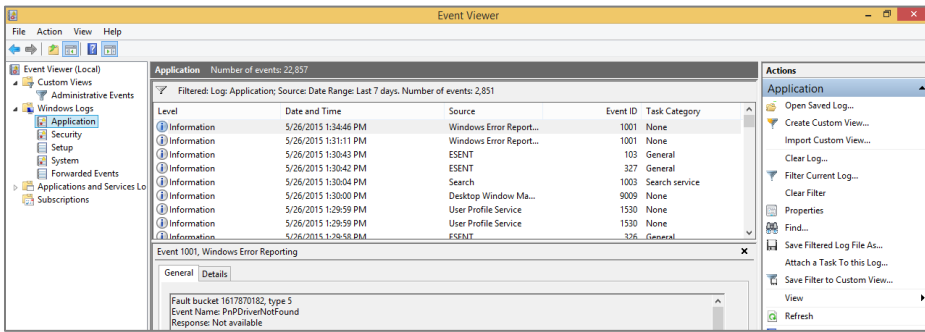


Click **Performance and Maintenance (only necessary in Windows XP)**, then click **Administrative Tools**, and then double-click **Computer Management (or open the “Event Viewer” at that point directly)**.



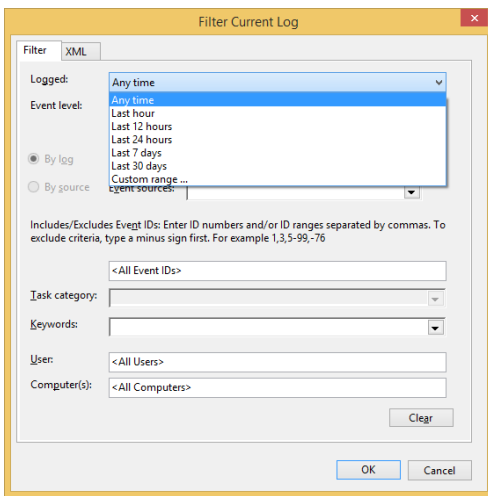
(Or, open the MMC containing the Event Viewer snap-in. In the console tree, click **Event Viewer**.)

The most important logs are “Application” and “System” (sometimes “Setup” could be useful too). They all are displayed in the console tree (under “Windows Logs”) in the Event Viewer window.

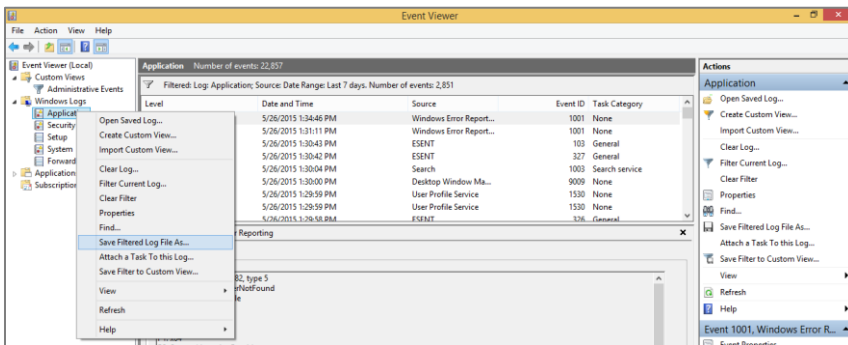


Please note: log-files could get very big, so it may be useful to filter these events. Right-clicking on the desired category (like *Application* or *System*) and select *Filter current Log...*

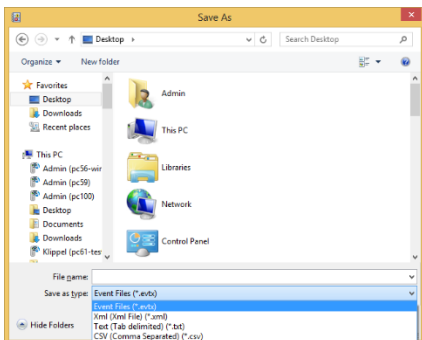
Most useful may be to limit the time of the events (e.g. last 24hours or last 7 days...). Make sure to select a reasonable range around the time you experienced problems, and also make sure to select **all Event levels** (“Critical”, “Warning”, “Verbose”, “Error” and “Information”)



After doing that you can save the filtered log file (“Save Filtered Log File As...”).



A file-dialog will open and you can give them a descriptive name and select the type of data (evtx, xml, csv, txt). The evtx-filetype might be the best option to review the file with the Microsoft “Event Viewer” on a different system.



These file mostly consists of text-data. So it will be very effective to compress them in a zip-archive before sending them in an email.

3 References

Specification	C3 - QC End-of-Line Test System Basic, Standard, Programmable & Stand-alone Version
Manual	Open in the manual section: <i>dB-Lab Software > Malfunction and Troubleshooting > USB Connection</i>
Application Notes	AN45 - Optimal QC setup for fixed measurement time
Tec Notes	TN06 - QC Endurance Test
Paper	None
Others	Internet resources to system tools / Microsoft® help resources

Find explanations for symbols at:

<http://www.klippel.de/know-how/literature.html>

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