

Remote control of delay generators and high voltage output devices from Stanford Research Systems

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Introduction

Over the course of the last year a few new useful tools for remotely controlling devices have been developed. The two devices in question are both created by Stanford Research Systems. The first is the DG535 delay generator, used in the several CLF target areas as the source of triggers to arm the various diagnostics needed on an experiment. The second is the PS375 20KV high voltage power supplies, used in conjunction with Thompson Spectrometers and other diagnostics to provide a consistent and strong potential difference between two plates under vacuum.

The software was developed in C# with a focus on combining the Keithley USB to GPIB converter and generic RS232 converters with an easy to use interface, as previously programs like Hyperterminal, which are reliant on text based commands had to be used. While this method does work with enough teaching, it is not very easy to use intuitively, especially with the vague style of commands used with older devices.

PS375 – High Voltage Power Supplies

There were several requirements for the creation of software to remotely control the power supplies. The primary concern was safety. While it is true that there are hardware solutions in use, such as vacuum interlocks on the power supplies, remotely turning on a power supply could cause grievous injury, so several further safeguards had been implemented. The core of the system is a multi-level user access system. The main window of the software can be seen in figure one.

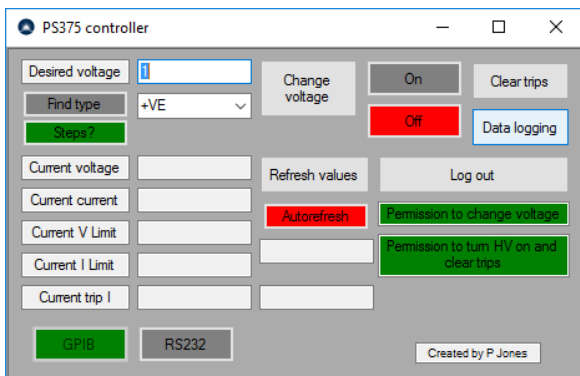


Figure 1 - Main Graphical User Interface of the PS375 Controller software

This access system limits key functionality which could be dangerous, such as turning the high voltage output on or varying the devices limits, are all kept locked behind a password which is only generated after the Electrical department had deemed the equipment and set up safe for use. This is a feature included to make the system more safe as remote control increases the risk of not knowing what is happening inside the area (for the person remotely controlling the device).

Once a time limited password has been given to the users, it will allow access to change the voltage in either steps or a single jump. This was introduced as an option to reduce the likelihood of tripping the power supplies as a sudden jump in voltage rather than a more gradual climb would produce a larger spike in current flow back to the device, leading to the trip. If the device does trip it is possible to clear the trip and try again remotely as well.

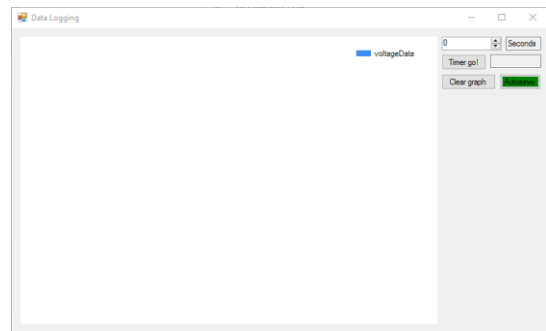


Figure 2 - Data logging window from the PS375 Controller software

The software also can read in the current status of the device in a variety of ways, featuring an option to automatically refresh the information every 15 seconds or to do so manually. Data logging was also implemented in two ways; the ability to log the data to a text file or have a graph updating live with the data. The data logging window of the software can be seen in figure two.

DG535 – Delay generator

The delay generator has several bits of core functionality, and operates on the principle of delays relative to specific channels to operate. An initial external trigger known as T0 is a fixed starting point. After a 75 ns internal delay the devices is ready to trigger the other channels. For each channel several bits of information can be altered. These include details relating to the length of the delay, which channel it is relative to, the output mode and other such settings. A timeline example can be found below in figure three.

Example of delays outputs

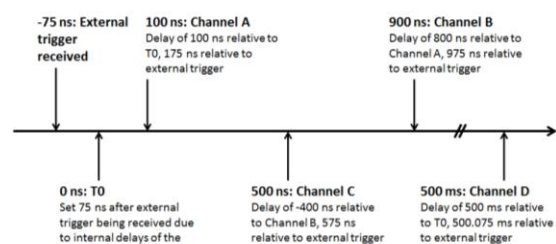


Figure 3 - Example of a possible timeline for the different channel outputs of a DG535

The controller software allows the remote control of the majority device settings through the use of the main display and several sub menus, which are trigger and output settings. The trigger submenu handles varying the trigger type and trigger-specific settings such as the 'Internal Trigger Rate', while the outputs sub menus handle varying the different channels output types and polarities.

The main interface can be seen in figure four to demonstrate the channel adjustment options. It is laid out with a channel on each row and the settings labelled at the top of each column. Due to the device's complexity it is advisable to have a good understanding of the various options available manually on the device before using the remote control software.

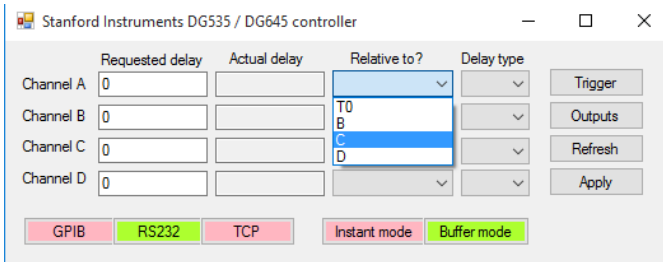


Figure 4 - Main Graphical User Interface of the DG535 Controller software

As can be seen from the interface the software can operate in two modes, buffer or instant mode. The first mode stores up to ~25 commands before applying them all in one go once the apply button is used. This mode will only update when the changes have been applied. The second mode is instant mode, which applies changes instantly, which means that the values displayed are current. However each change takes a couple of seconds to apply on the device, which can cause frustration when applying a large number of changes, so it is primarily for use once the device has been fully set up and only small changes need to be made.

The current version of the software does support an additional communication protocols which the DG535 does not support, RS232, which allow the possibility of using the newer DG645 to a limited degree. Due to differences in the command syntax between the devices and the removal of the relative channel structure which was a key part of the DG535, there is only partial support between the two, mainly focusing on the rear outputs of the device. A planned expansion of the project is to fully support the DG645 in a combined application for both.

Conclusion

Over the past year two applications were developed to improve the remote control capabilities of devices in the Vulcan target areas, namely the PS375 high voltage supply and the DG535 delay generator. With these pieces of software, remote control through a streamlined user interface is available rather than having to resort to controlling the devices from the command line directly, an often tiring and difficult process, allowing users to access the devices while areas are searched or otherwise unavailable.

Acknowledgements

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